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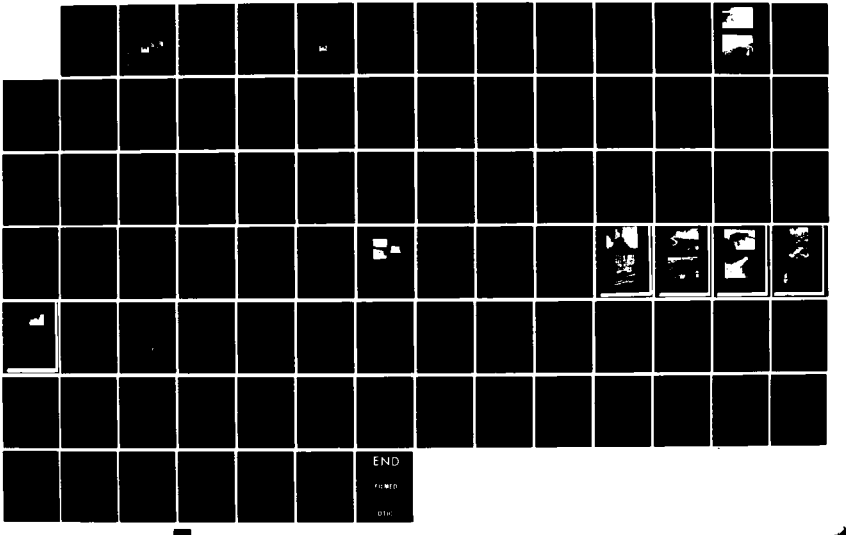

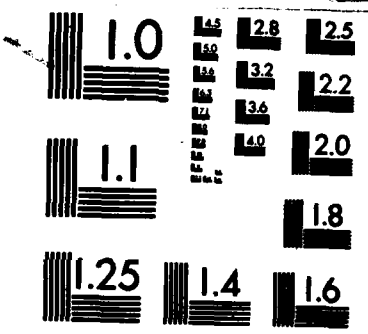

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TAUNTON RIVER BASIN
BROCKTON, MASSACHUSETTS

THIRTY ACRE POND DAM
MA 00423

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

MAY 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Brockton Massachusetts
Beaver Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Thirty Acre Pond Dam is an earthen dam about 600 ft. long and 13 ft. high. The dam is in fair condition. The dam is considered to be small in size and has a high hazard potential. The spillway test flood selected is Probable Maximum Flood. Investigations are recommended to check the adequacy of the structure under seismic loading, etc.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

SEP 17 1979

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

I am forwarding to you a copy of the Thirty Acre Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, City of Brockton, Brockton, Massachusetts 02401.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

TAUNTON RIVER BASIN
BROCKTON, MASSACHUSETTS

THIRTY ACRE POND DAM
MA 00423

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THIRTY ACRE POND DAM
MA 00423

TAUNTON RIVER BASIN
BROCKTON, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No. : MA 00423
Name of Dam: THIRTY ACRE POND DAM
Town: BROCKTON
County and State: PLYMOUTH COUNTY, MA
Stream: BEAVER BROOK
Date of Inspection: 4 OCTOBER 1978 with supplemental visit 23 MARCH 1979

BRIEF ASSESSMENT

Thirty Acre Pond Dam is an earthen dam approximately 600 feet long and 13 feet high. To the east of the dam, there is an earthen dike approximately 300 feet long and 6.5 feet high. An emergency spillway is near the right abutment of the dam while a stoplogged controlled concrete intake and twin 36-inch concrete pipe outlet service spillway is near the left abutment of the dam. The dam and dike, originally constructed around the year 1900, currently impound waters to form a recreational pool.

The dam is in fair condition. Seepage was observed in a number of locations along the toe of the dam including both spillways. Local erosion and non-vegetated areas are present on the dam. The dike has little slope and crest protection.

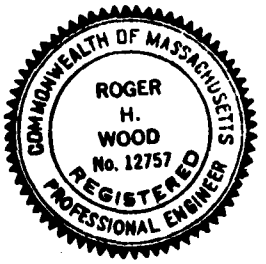
Based on the size classification, small, and hazard classification, high, in accordance with the Corps of Engineers guidelines, the spillway test flood selected is the Probable Maximum Flood (PMF). Hydraulic analysis indicates the peak test flood outflow would be 3150 cfs while the total maximum capacity of the spillways with the pond water surface at the crest of the dam and the flashboards removed is estimated to be 392 cfs. The test flood selected would result in an overtopping of the dam and dike by 1.1 feet at peak discharge at which time 18 percent of the flow would be passing through the service spillway outlet pipes and over the ungated spillway weir.

Investigations are recommended to check the adequacy of the structure under seismic loading, the effect of seepage on the dam and any necessary remedial action, the adequacy of the left dike and the need and means of increasing the spillway capacity. Remedial measures recommended are the clearing of brush, repair of eoroded areas, establishing of vegetation on bare areas, the repointing of stone masonry, the patching of concrete spalls and eroded surfaces, and the establishment of a program of annual technical inspections. The remedial measures and investigations should be performed by the Owner within one year of receipt of this report.

CAMP DRESSER & McKEE INC.

Roger H. Wood

Roger H. Wood
Vice President



This Phase I Inspection Report on Thirty Acre Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

Joseph W. Finegan

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), or a fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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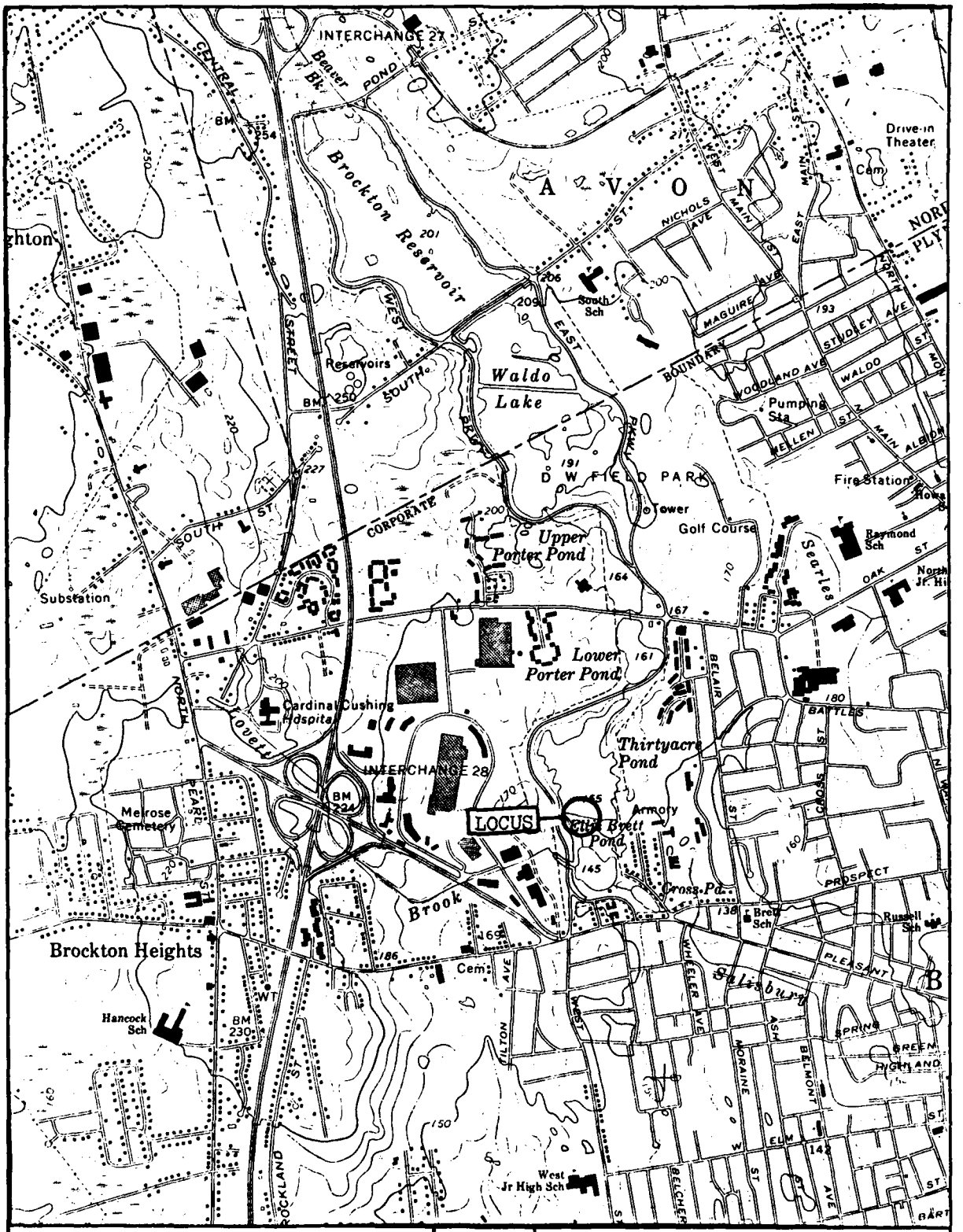
1. Overview of dam from right abutment.

2. Overview of dam from left abutment.



DAM THIRTY ACRE POND DAM

IDENTIFICATION NO. MA 00423

LOCATION MAP
USGS QUADRANGLE
Brockton, Massachusetts

APPROX. SCALE: 1" = 2000'

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
THIRTY ACRE POND DAM

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Camp Dresser & McKee Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Camp Dresser & McKee Inc. under letters of 12 July 1978 and 23 October 1978 from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-78-C-0354 has been assigned by the Corps of Engineers for this work. Haley & Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for the soils and geological portions of the work.

b. Purpose - The primary purpose of the investigation is to:

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location - Thirty Acre Pond Dam is located on Beaver Brook, in the City of Brockton, Massachusetts, as shown on the report's Location Map. It is one of seven surface bodies of water in the D.W. Field Park (a recreational facility which serves the City). The main dam and spillways are located on the southernmost portion of Thirty Acre Pond.

b. Description of Dam and Appurtenances - Thirty Acre Pond Dam is an earth embankment with a service spillway controlled by stop-logs near the left abutment (looking downstream) and an emergency spillway near the right abutment. There is no low-level reservoir drain at the dam site. The total length of the dam, including the spillways, is approximately 600 ft. There is evidence that the shoreline was raised by building a separate 300 ft long dike approximately 200 ft to the left of the dam.

The maximum height of the dam is approximately 13 ft, as measured from the streambed at the left end. Typically, the embankment is about 10 ft in height, relative to the downstream toe. The top of the embankment is generally from 18 to 20 ft wide, with exceptions at two locations. Immediately to the right and left of the emergency spillway the embankment crest narrows to 9 ft, and to the left of the service spillway it widens to greater than 40 ft. The upstream slope is irregular, retained in part by sections of low, quarry-cut stone masonry walls.

The irregular downstream slope is generally about 1 vertical (V) to 2 horizontal (H), except near the service spillway where it approaches 1V to 1.5H. At the emergency spillway, the downstream slope occurs in a series of approximately 6 steps, each of which has a horizontal berm approximately 2 ft wide. Each berm is supported by a line of large boulders. There are occasional shrubs on the berms for ornamental purposes.

The dike extending for about 300 ft to the left of the dam apparently consists of granular fill placed along the pond shoreline. It has a width of approximately 10 ft at the top, irregular side slopes, and a maximum height of 6.5 ft above the natural ground surface on the downstream side. Although most of the dike crest is estimated to be slightly higher than the main dam embankment, the south end appears to be about 0.5 ft lower than the dam crest.

c. Size Classification - Thirty Acre Pond Dam has a height of 13 feet and a storage capacity of 234 acre-feet at top of dam. According to guidelines established by the Corps of Engineers, the dam is classified in the small category.

d. Hazard Classification - The results of the dam failure analysis (Section 5.1e) indicates Ellis Brett Pond Dam and Cross Pond Dam (Elmwood Avenue) would be overtopped and significant flooding potential would exist to downtown sections of the City which include residential, industrial, and commercial structures. The dam is therefore classified as having a "high" hazard potential.

e. Ownership - The dam and pond are owned by The City of Brockton. The Owner is represented by Mr. John J. Dorgan, Superintendent of Parks, City Hall, Brockton, MA 02401 (Phone: 617/580-1100 extension 133).

f. Operator - Mr. John J. Dorgan is assigned responsibility for operation of the dam.

g. Purpose of the Dam - Thirty Acre Pond Dam was originally constructed in order to form a surface body of water which would provide ice for the Brockton Ice and Coal Company. However, since 1927, the pond has been used solely for recreational purposes.

h. Design and Construction History - Thirty Acre Pond Dam was originally constructed in approximately 1900. The name of the engineer who designed the dam as well as the name of the contractor who constructed the dam is not known.

i. Normal Operational Procedure - There is no defined operational procedure for the dam. Stoplogs are added or removed at the discretion of the members of the Park Department. The department attempts to keep approximately 2 to 2-1/2 feet of stoplogs in the service spillway.

1.3 Pertinent Data

Elevations given in this report are on National Geodetic Vertical Datum (NGVD) formerly referred to as Mean Sea Level. They are based on a survey by Camp Dresser & McKee for a 1968 Master Plan Report.

a. Drainage Area - The drainage area to Thirty Acre Pond Dam is approximately 3.61 square miles (2,310 acres). The pond surface itself comprises 1.2 percent (27 acres) of the total drainage area. The watershed's topography is primarily densely forested rolling terrain with large portions of wetlands and surface bodies of water.

b. Discharge at Damsite - Four notable floods have occurred in the watershed since the construction of Thirty Acre Pond Dam: March 16-19, 1936; September 21, 1938; August 19-21, 1955; and March 17, 1968. The total storm rainfall for these floods were respectively: 1.5 inches in 3 days; 5 inches in 5 days; 13.76 inches in 72 hours; and 6.33 inches in 48 hours. However, there are no records of the pond's water surface elevation during these events.

(1) Outlet works size (service spillway----------2-36" pipes

(2) Maximum known flood at damsite----------August 18-21, 1955

(3) Ungated spillway capacity at top of dam
174 cfs @ 160.5 elev.

(4) Ungated spillway capacity at test flood elevation
318 cfs @ 161.6 elev.

(5) Gated spillway capacity at normal pool elevation-------N/A

(6) Gated spillway capacity at test flood elevation
242 cfs @ 161.6 elev.

(7) Total spillway capacity at test flood elevation
560 cfs @ 161 6 elev.

(8) Total project discharge at test flood elevation
3150 cfs @ 161.6 elev.

c. Elevation (ft. above MSL)

(1) Streambed at centerline of dam----------147.5

(2) Test flood tailwater----------Unknown

(3) Upstream portal invert diversion tunnel----------None

(4) Recreation pool----------157.33

(5) Full flood control pool----------N/A

(6) Spillway crest----------Service: 155
Emergency: 158.2

(7) Design surcharge (Original Design) ----------Unknown

(8) Top of dam----------160.5

(9) Test flood surcharge----------161.6

d. Reservoir

(1) Length of test flood pool----------0.34 miles

(2) Length of recreation pool----------0.34 miles

(3) Length of flood control pool----------N/A

e. Storage (acre-feet)

(1) Recreation pool	125
(2) Flood control pool	N/A
(3) Spillway crest pool	Service: 64 Emergency: 151
(4) Top of dam	234
(5) Test flood pool	291

f. Reservoir Surface (acres)

(1) Recreation pool	27
(2) Flood control pool	N/A
(3) Spillway crest	Service: 7 Emergency: 28.5
(4) Test flood pool	46
(5) Top of dam	36

g. Embankments

	Dam	Dike
(1) Type	Earth embankment	Earth embank.
(2) Length	Approx. 600 ft, including spillways	300 ft+
(3) Height	Approx. 13 ft maximum	6.5 ft max.
(4) Top width and elevation	18 to 20 ft except at spillways; approx. 9 ft immediately right and left of ungated spillway, 40 ft at service spillway. Elev. 160.5	10 ft+ Elev. 160.5+ except south end at elev. 160.0
(5) Side slopes	Irregular upstream; approx. 1V to 2H downstream, steepest 1V to 1.5H	Irregular
(6) Zoning	Unknown	Unknown

(7) Impervious core	Unknown	Unknown
(8) Cutoff	Unknown	Unknown
(9) Grout curtain	Probably none	Probably none

h. Diversion and Regulating Tunnel---------- None

i. Spillways:	Service	Emergency
(1) Type	Sharp-crested	Broad-crested
(2) Length of weir	6.4	15
(3) Crest elevation	155	158.2
(4) Gates	Stoplogs	None
(5) U/S Channel	None - at edge of pond	
(6) D/S Channel	1V to 2H	1V to 2H

j. Regulating Outlets - The only regulating outlet is the service spillway. The intake width is approximately 6 feet 3 inches and has an invert approximately 5-1/2 feet below the crest of the dam. The intake has provisions for stoplogs and normally a minimum of 30 inches of stoplogs are in place. Flow from the intake is directed into two 36-inch reinforced concrete pipes which discharge at the toe of the dam.

SECTION 2: ENGINEERING DATA

2.1 Design Records - No design records for this dam are available.

2.2 Construction Records - No construction records for this dam are available.

2.3 Operation Records - No operation records other than inspection reports on the facility were located.

2.4 Evaluation

a. Availability - Inspection reports described above are available at the Plymouth County Engineering Department, Plymouth, MA and at the division of Waterways, Nashua Street, Boston, MA.

b. Validity - With the exception of the embankment at the service spillway, the sketches of the dam and its outlet structures which accompany the inspection reports were in agreement with the features observed in the field.

c. Adequacy - The available data, in combination with the visual evaluation described in the following section, is adequate for the purposes of the Phase I investigation.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General - The Phase I visual examination of the Thirty Acre Pond Dam was conducted on 4 October 1978. A supplemental visit was made on 23 March 1979. In general, the dam was observed to be in fair condition. The reservoir level at that time was approximately at elevation 157.5.

Visual inspection checklist lists for the site visit are included in Appendix A and selected photographs are given in Appendix C.

b. Dam - The earth embankments of the dam and the dike are generally in fair condition. There is no visual evidence of settlement, lateral movement, piping or major erosion at this time. However, significant seepage, which varies with the level of the pond, has been observed at the dam. The spillways shown in Photos 5 and 7 are in good condition.

The following specific items were noted:

(1) The top of the dam embankment at the right end is bare, and a bare path at least 4 ft wide has been worn along the axis for the entire length of the crest, as shown in Photos 1, 2 and 3. Grass on either side of the path was mowed. Both the upstream and downstream slopes of the embankment are covered by brush and trees, some of which are as large as 12 in. in diameter, as shown in the same photos. Sand and gravel fill with cobbles and boulders is exposed on the downstream slope around the trees. Localized erosion of the slope was observed where there is no vegetative cover. Part of the length of the upstream face is protected by cut stone masonry walls and part by broken rock and boulders, as shown in Photo 3.

(2) Seepage was observed near the toe of the downstream dam slope at several locations:

(1) A small stream was noted between the two 36-inch concrete outlet pipes for the stoplogged spillway structure, as shown in Photo 9. This flow may originate from leakage through an open joint in the right pipe, one section from the end, or from under the spillway.

(b) Approximately 10 to 15 ft downstream of the outlet pipes, there are two small streams flowing into the brook from the right bank. While the water is clear, the bed of the stream is reddish-brown.

(c) At the downstream toe of the embankment within 200 ft to the right of the spillway outlet pipes, there are several wet areas at the location shown in Photo 4. The bed of these areas is again stained a reddish-brown color and the combined flow from the areas to a stagnant pool located about 40 ft downstream of the toe was estimated to be about one gallon per minute at the time of the visual inspection.

Seepage was noticed in an area 50 to 100 feet from the pipes. This area has a reported abandoned culvert and has a history of seepage.

This condition was observed to be more active on 23 March 1979 during a supplemental visit to the site, when the level of the pond was 0.5 ft higher. Seepage flow was emerging approximately 100 ft right of the pipes near the downstream toe. At that time, the seepage rate at this specific location was estimated to be less than one gallon per minute. Soil particles were not observed in the seepage flow.

(d) At the emergency spillway, the lowest horizontal berms of the adjacent landscaped downstream slope are wet and water is ponded downstream to the spillway, as shown in Photo 6. The source of seepage could not be detected, but clear water was flowing at the rate of approximately 1 to 2 gallons per minute in the downstream channel, with no flow over the spillway.

(3) The dike to the left of the dam appears to be constructed of sand and gravel fill and has little or no vegetation cover or slope protection. Part of the crest is slightly lower than the dam embankment. Trees are growing in both slopes of the dike as shown in Photos 10 and 11.

(4) The service spillway has an eroded invert and pier between the concrete pipes. Minor concrete spalls are present at the intake as shown in Photo 8.

(5) Minor undercutting of the aprons is occurring at the right spillway and the entrance stone walls have some loose and/or missing mortar at the joints.

c. Appurtenant Structures - The bridge over the emergency spillway, as shown in Photos 1 and 5, is in good condition.

d. Reservoir Area - The reservoir is surrounded by moderately sloped, heavily wooded hills. No development exists along the banks of the reservoir, nor in the immediate upstream and downstream portions of the drainage area.

e. Downstream Channel - Beaver Brook conveys the discharge from the outlet works of the dam to Salisbury Brook, a distance of about 0.5 miles. Along this course, two dams and hydraulic control structures, two ponds, and two culverts are located.

3.2 Evaluation

The dam embankment at Thirty Acre Pond Dam appears to be performing satisfactorily at the present time. The bare and eroded areas on the top of the dam increase the potential for damaging erosion if the dam is overtopped, but short-term erosion would not be expected to result in dam failure because of the broad crest of the embankment. Normally, trees are considered to be a potential cause of breaching of a dam embankment if they are uprooted during a storm. However, since the embankment at this site is broad in relation to its height, the trees are not considered to be a major hazard. The clear seepage that was observed appears to be related to the pond elevation, and could present serious problems under conditions of higher than normal water levels. The left dike has little or no erosion protection. The crest width of this embankment makes it more susceptable than the dam to erosion by short-term drainage. The trees present on both the downstream and upstream slopes are also a concern at the dike due to the limited crest width. The spillways are in good condition with only minor deficiencies observed.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures - There is no defined operation and maintenance procedure manual for the dam. Stoplogs are added or removed at the discretion of the Park Department.

4.2 Maintenance of Dam - In general, it appears that the major portion of this facility is being maintained properly. Recreational use of the Thirty Acre Pond Dam embankment has worn off the grass cover on the top of the dam and moderate erosion has occurred. There are trees growing on both the upstream and downstream sides of the embankment.

4.3 Maintenance of Operating Facilities - Maintenance of the operating facilities is performed at the discretion of the Superintendent of Parks for the City of Brockton, MA. It appears that the stoplogs are being maintained and the twin 36-inch concrete pipes which lead from the service spillway to a natural channel downstream of the dam's embankment are kept clear and free of debris.

4.4 Description of any Warning System in Effect - There is no established warning system or emergency preparedness plan in effect for this structure.

4.5 Evaluation - In general, the maintenance on this dam is being attended to. However, the ground cover on the top of the dam should be restored so as to prevent any further erosion and to aid in the prevention of dam failure should an overtopping of the dam occur.

The current informal practice of adding and removing stoplogs should be formalized to insure that the stoplogs will be removed during major flooding events.

A written Operation and Maintenance Manual and a warning system and emergency preparedness plan should be established for this structure.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features -

a. General - Thirty Acre Pond Dam is a low spillage project. The limited capacity will cause overtopping of the structures during major flooding events. The effect of storage capabilities during these events will be minimal. The adjustment of the pond's water surface elevation is done at the discretion of the Brockton Park Department. The combined discharge capacities of both the service and emergency spillways with the flashboards removed is 392 cfs at top of dam (elev. 160.5).

b. Design Data - No construction or record plans were found for Thirty Acre Pond Dam. No original hydraulic nor hydrologic design data were found. However, a report entitled "Master Plan Study for D.W. Field Park" submitted to the Brockton Park Commission in April 1968 by Camp Dresser & McKee Inc. made the recommendation that the spillway system at Thirty Acre Pond Dam be reconstructed to pass the flows generated by a 6-hour rainfall of 13 inches with an 80 percent runoff. Therefore, it was recommended that a spillway and outlet channel be constructed and the dam raised to provide a total spillway capacity of 1,500 cfs. However, it appears from the visual inspection that the modifications suggested in the aforementioned report were not made.

c. Experience Data - No records of past floods are available for the dam site.

d. Visual Observations - A visual inspection was made of the portions of the outlet works that are accessible and not submerged. Both the service and emergency spillways were observed to be in good hydraulic condition.

e. Test Flood Analysis - Based upon the Corps of Engineers Guidelines, the recommended test flood for the size (small) and hazard potential (high) is within the range of 1/2 PMF to a full PMF. The full PMF was selected for this dam because of the considerable development present downstream of the dam. The "SCS-TP-149, Method for Estimating Volume and Rate of Runoff in Small Watersheds" was used as a guide for determining the inflow hydrograph in Thirty Acre Pond for the probable maximum flood (24 inches of rainfall in 6 hours). The peak inflow was calculated to be 3,150 cfs. This flow was routed through the two spillway outlets at the dam using the method for flood routing presented in "Water Supply and Wastewater Disposal" by Fair and Geyer. The service spillway flashboards were assumed to have been removed and a maximum outflow of 3,150 cfs at a water surface elevation of 161.6 feet resulted from the routing analysis indicating no reduction during severe flooding conditions. Since this flow

would result in an overtopping of the dam by approximately 1.1 feet, the spillway system is not sufficient to pass the test flood.

f. Dam Failure Analysis - Based on the Corps of Engineers Guidelines for Estimating Dam Failure hydrographs and assuming that a failure would occur along a section 240 feet in length with the water level 5.5 feet above the service spillway crest (elev. 160.5), the failure would result in a peak outflow of approximately 18,900 cfs. Further analysis which incorporates the tailwater effects created by Ellis Brett Pond Dam, the top of which is about 4 ft. higher than the toe of Thirty Acre Pond Dam, resulted in a peak failure outflow of approximately 3,200 cfs. A flow of this magnitude would result in the overtopping of Ellis Brett Pond Dam (Elmwood Avenue), cause significant flooding of homes along Salisbury Brook through downtown sections of Brockton. Furthermore, the overtopping of these two downstream dams would greatly increase the possibility of their failing. The failure of even one of these two structures would augment the failure flows and also the potential for loss of life as well as the economic losses incurred by damage to residential, commercial, and industrial structures. Consequently, this dam is classified as having a "high" hazard potential.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations - There was no visible evidence of dam embankment instability during the site examination on 4 October 1978. There was no evidence of erosion or piping where seepage was noted at the outlet pipes and in areas right of the outlet. Therefore, the observed seepage is not considered to pose an immediate hazard to the stability of the downstream slopes.

b. Design and Construction Data - There are neither design drawings nor construction data which would show the embankment cross-section and the physical properties of the materials used to construct the embankment. Therefore, a theoretical analysis of the embankment stability is not possible.

Nevertheless, since Thirty Acre Pond Dam is a low dam with a broad crest and side slopes which for the most part are typical of other New England dams, the embankment is considered to be adequately stable for normal pond levels under static loading conditions as long as seepage conditions do not change.

c. Operating Records - There is neither instrumentation installed at the dam site nor records of performance under prior maximum loading conditions to aid in the stability evaluation.

d. Post-Construction Changes - There is evidence of several post construction changes that might influence the safety of the dam, based on certain observed features that differ from information contained in prior inspection reports. Specifically, plan and cross-sectional sketches attached to the county inspection reports indicate that (1) the top of the embankment was formerly only 8 ft wide, (2) an "old culvert now filled" is located 25 ft to the right of the service spillway and (3) the fixed crest of the service spillway was 7.3 ft below the top of the spillway walls.

It was noted during the site visit on 4 October 1978 that the top of the embankment is now typically 18 to 20 ft wide. There was no discernible evidence of an old filled culvert noted at the downstream toe in this area. The fixed crest of the service spillway is now 5.5 ft below the top of the spillway walls, reducing the available freeboard. The downstream spillway walls have apparently been closed over, and the spillway and discharge pipes have been backfilled over to the level of the top of the widened embankment.

The state inspection report dated 5 December 1972 includes the statement "new top soil placed and seeded on top of dam this year. Also new concrete front face to part of dams near spillway". The embankment may have been widened at this time. Otherwise, no references to the year or method of construction, or the specific post-construction changes listed above, were disclosed.

Widening the abutment may have increased the stability of the dam, but may also have created problems is fill was placed over vegetation or not properly compacted. The filled culvert could be a cause of the observed seepage if the conduit was not properly sealed. Another potential line of seepage could be under the service spillway crest, depending on the details of how the crest was raised. Further information is needed to assess the effect of these post-construction changes on the stability of the dam.

e. Seismic Stability - Thirty Acre Pond is located in Seismic Zone 3. Pertinent data needed for a theoretical seismic stability analysis of the embankments are not available. Therefore, the stability of the embankments during an earthquake is unknown.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - The visual examination of Thirty Acre Pond did not reveal any evidence of failure or conditions which would warrant urgent remedial treatment. However, because of the need for maintenance and additional investigation that is outlined hereinafter, the project is considered to be in fair condition.

b. Adequacy of Information - Since there was a lack of engineering data available, nearly all of the information for the Phase I investigation had to be obtained from visual examination and limited measurements at the site. This information has been sufficient for the purpose of this investigation but it does not permit detailed evaluation of seismic stability and seepage.

c. Urgency- The recommended additional investigations and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken and completed within one year after receipt of this report by the Owner.

d. Need for Additional Investigation - Additional investigations should be performed by the Owner as outlined in the following section.

7.2 Recommendations

It is recommended that the owner engage a registered professional engineer to undertake the following investigations and implement corrective action as required:

1. Assess the potential for a failure and/or excessive movement of the dam and dike embankments under earthquake loading conditions for Seismic Zone 3.

2. Investigate the seepage condition near the downstream toe of the embankment and assess the need for remedial measures. The investigation should include systematic monitoring of the seepage at the base and lowest berm of the ornamental embankment at the emergency spillway, at the service spillway discharge pipes, and near the downstream slope right of the pipes. Particular attention should be paid to the possible presence of soil

particles in the seepage flow and to changes in the flow during periods when the pond level is high.

3. Investigate the geometry and adequacy of the dike to the left of the dam to arrive at corrective measures. As a minimum, these would be expected to include reshaping the crest and slopes, the removal of brush and trees, and providing erosion-resistant surface protection. Stability and seepage potential should also be considered in the investigation.

4. Investigate the need and means of increasing the spillway capacity.

7.3 Remedial Measures

a. Operation and Maintenance Procedures - It is recommended that the following remedial work be undertaken by the Owner, in addition to the investigations outlined in Section 7.2, to correct deficiencies noted during the visual examination:

1. Clear the embankment of brush and cut weed and plant growth between the trees at least once every year. After clearing, examine the embankment for evidence of animal burrowing activity and seepage.

2. Reshape the downstream embankment slope and place topsoil as necessary to establish and maintain vegetative cover.

3. Repair local eroded areas in the embankment and establish turf on the crest to resist erosion. If foot traffic does not permit such a growth, the trafficked areas should be protected by other means, such as pavement or crushed stone.

4. Repair the eroded concrete invert and patch the concrete spalls in the service spillway intake.

5. Repoint the stonework at the front of the emergency spillway.

6. Fill all undercut areas with concrete at the upstream and downstream aprons of the emergency spillway.

7. Prepare an operations and maintenance manual for the dam. The manual should include provisions for annual technical inspection of the dam and for surveillance of the dam during periods of heavy precipitation and high reservoir water levels; special attention should be given to monitoring seepage conditions and the removal of stoplogs during major flooding events. The manual should delineate the

routine operational procedures, including the placement and removal of stoplogs, and maintenance work to be done on the dam to ensure satisfactory operation and to minimize deterioration of the facility.

8. Develop a written emergency preparedness plan and warning system in cooperation with local officials and downstream inhabitants.

7.4 Alternatives - There are no practical alternatives recommended.

APPENDIX A

INSPECTION TEAM ORGANIZATION AND CHECKLIST

	Page No.
VISUAL INSPECTION PARTY ORGANIZATION	A-1
VISUAL INSPECTION CHECKLIST	
Dam Embankment	A-2
Spillway	A-3
Outlet Works	A-4
Hydrologic-Hydraulic Considerations	A-5

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

DAM: Thirty Acre Pond Dam

DATE: October 4, 1978 with 23 March 1979 supplemental visit

TIME: 2:30 p.m.

WEATHER: Partly to mostly cloudy - 55-60° F

WATER SURFACE ELEVATION UPSTREAM: 9" below spillway crest

STREAM FLOW: Q approx. 1 cfs

INSPECTION PARTY:

1. Roger H. Wood - CDM (Structural/Operations)
2. Donna L. B. D'Amore - CDM (Hydraulics-Hydrology)
3. Charles E. Fuller - CDM (Hydraulics-Hydrology)
4. Harl P. Aldrich - Haley & Aldrich (Soils)
5. Richard Brown - Haley & Aldrich (3-23-79 supplemental visit)
6. _____

PRESENT DURING INSPECTION:

1. _____
2. _____
3. _____
4. _____

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Thirty Acre Pond DATE: 4 October 1978

EMBANKMENT: Dam

CHECK LIST	CONDITION
1. Upstream Slope	
a. Vegetation	1. a. Grass with some brush and numerous trees up to 12 in. diam.
b. Sloughing or Erosion	b. Minor local erosion noted.
c. Rock Slope Protection - Riprap Failures	c. Several short sections of low quarry cut stone masonry wall. Some broken rock and boulders near water line in areas where trees occur.
d. Animal Burrows	d. None observed.
2. Crest	
a. Vegetation	2. a. Crest bare on centerline with mowed grass each side of path.
b. Sloughing or Erosion	b. None observed.
c. Surface cracks	c. None observed.
d. Movement or Settlement	d. None observed.
3. Downstream Slope	
a. Vegetation	3. a. Brush and trees, except each side of spillway.
b. Sloughing or Erosion	b. None observed.
c. Surface cracks	c. None observed.
d. Animal Burrows	d. None observed.
e. Movement or Cracking near toe	e. None observed.
f. Unusual Embankment or Downstream Seepage	f. Seepage noted at and near toe of embankment near the outlet end of twin concrete pipes at left end of embankment. About 30 to 40 ft. right of outlet pipes, water is ponded near toe of embankment.
g. Piping or Boils	g. None observed.
h. Foundation Drainage Features	h. None evident.
i. Toe Drains	i. None evident.
4. General	
a. Lateral Movement	4. a. None observed.
b. Vertical Alignment	b. Good.
c. Horizontal Alignment	c. Good.
d. Condition at Abutments and at Structures	d. Satisfactory
e. Indications of Movement of Structural Items	e. Minor, some masonry blocks displaced.
f. Trespassing	f. Frequent; dam is in a park open to the public.
g. Instrumentation Systems	g. None evident.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Thirty Acre Pond DATE: 4 October 1978

SPILLWAY: _____

CHECK LIST	CONDITION
1. Approach Channel a. General Condition b. Obstructions c. Log Boom etc.	1. a. Good, invert paved with concrete, minor undercut present, some loose mortar in front wall. b. None observed. c. None.
2. Weir a. Flashboards b. Weir Elev. Control (Gate) c. Vegetation d. Seepage or Efflorescence e. Rust or Stains f. Cracks g. Condition of Joints h. Spalls, Voids or Erosion i. Visible Reinforcement j. General Struct. Condition	2. a. None. b. None. c. Ornamental spillway - some planting present. d. None observed. e. None observed. f. N/A g. N/A h. Bottom steps in cascade have hollow sounding areas. i. N/A j. Good.
3. Discharge Channel a. Apron b. Stilling Basin c. Channel Floor d. Vegetation e. Seepage f. Obstructions g. General Stuct. Condition	3. a. Concrete apron - some minor scour present. b. Pool with earth invert. c. Overgrown grass in pool; woodland stream beyond, trees along channel. d. See c. e. Water at base of cascade, marshy area right side. Water in D/S channel. No flow observed in pool area. f. No material obstruction observed. g. Good condition.
4. Walls a. Wall Location _____ (1) Vegetation (2) Seepage or Efflorescence (3) Rust or Stains (4) Cracks (5) Condition of Joints (6) Spalls, Voids or Erosion (7) Visible Reinforcement (8) General Struct.Condition	4. See 1.
5. Bridge	5. The steel beams, steel railing and timber flooring are in excellent condition.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Thirty Acre Pond DATE: 4 October 1978
OUTLET WORKS:

CHECK LIST	CONDITION
1. Inlet a. Obstructions b. Channel c. Structure d. Screens e. Stop Logs f. Gates	1. a. None except earth piled in front of stop logs. b. Entrance at face of reservoir. c. Concrete - small spall right side & eroded invert. Granite front wall in excellent condition. d. None. e. Stop logs in good condition. f. None.
2. Control Facility a. Structure b. Screens c. Stop Logs d. Gates e. Conduit f. Seepage or Leaks	2. a. Entrance to RC pipe eroded. b. None. c. None. d. None. e. 2-36 RC pipe. D/S joint broken and open. f. Flow coming from between pipes D/S. May be from broken joint (see 2e).
3. Outlet a. Structure b. Erosion or Cavitation c. Obstructions d. Seepage or Leaks	3. a. No structure at end of pipes. End of pipes have very minor chips. b. No material erosion. c. None observed at outlet. D/S is woodland stream. d. See 2d.
4. Mechanical and Electrical a. Crane Hoist b. Hydraulic System c. Service Power d. Emergency Power e. Lighting f. Lightning Protection	4. N/A

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Thirty Acre Pond DATE: 4 October 1978

HYDROLOGIC-HYDRAULIC CONSIDERATIONS:

CHECK LIST	CONDITION
1. Upstream Watershed a. Type of Terrain b. Hydrologic Controls	1. a. Rolling to flat, heavily wooded; several wetland areas, minimal development. b. Lower Porter Pond, Upper Porter Pond, Waldo Lake, Brockton Reservoir.
2. Reservoir a. Type of Terrain b. Development	2. a. Side slopes vary from flat to steep areas. b. No development.
3. Spillway a. Adjacent Low Points b. Spillway Approach (Slope) c. Spillway Discharge (Slope) d. Spillway Type	3. Main Spillway a. None. b. Not possible to determine. c. Vertical. d. Sharp-crested weir. Ornamental Spillway a. None. b. Not possible to determine. c. Vertical (.392). d. Ogee weir.
4. Downstream Watershed a. Reach No. (1) Control (Bridge, dam, culvert, etc.) (2) Channel Characteristics (3) Development (4) Visible Utilities (5) Special Problems (Hospital, etc.)	4. a. Reach No. 1 (1) Ellis Brett Pond Dam (2) Natural channel approximately 10 feet wide. (3) Moderate residential development. (4) None. (5) None. b. Reach No. 2 (1) Cross Pond Dam. (2) Natural channel approximately 12 feet wide. (3) Dense residential and commercial development. (4) Overhead Telephone and Electric. (5) None.

APPENDIX B

LIST OF AVAILABLE DOCUMENTS AND PRIOR INSPECTION REPORTS

		Page No.
LIST OF AVAILABLE DOCUMENTS		
List of Documents		None
PRIOR INSPECTION REPORTS		
DATE	BY	
1. September 1938 thru October 1969	Plymouth County Engineer	B-1
2. December 5, 1972	Mass. Dept. Public Works	B-2 thru B-4
3. June 26, 1975	Mass. Dept. Public Works	B-5 thru B-7
4. July 31, 1975	Mass Dept. Public Works with description of dam	B-8 thru B-11

DAM NO. 136

COUNTY OF PLYMOUTH, MASSACHUSETTS
ENGINEERING DEPARTMENT
INSPECTION OF DAM AND RESERVOIRS

Inspector Bamber & Greaves Date Nov. 1936 City or Town Brockton

Location Southerly end of 30 Acre Pond off Field Parkway (Salisbury Brook)

Owner City of Brockton Use Ornamental Pond

Material and Type Gravel, Clay & Earth Dyke with one ornamental stone spillway and one concrete spillway with flashboards

Maximum Head in Feet (Full Pond Level to Bottom of Spillway) 10 feet

Length 660 feet Width 8 feet plus

Area of Watershed 7 Sq. Miles. Capacity 60,000,000 Gallons

Length of Overflow or Spillway 15 feet Outlets (Pipes or Flumes)

Sluiceway 6'-3" wide by 3' deep emptying through 2-36" pipes.

Dam Constructed by Date

Recent Repairs Date

Evidence of Leakage None.

Condition Good.

Topography of Country Below Ellis Brett & Crass Ponds and Salisbury Brook thru Brock

Nature, extent, proximity, etc. of buildings, roads or other property in danger if failure should occur

Would carry out Ellis Brett dam, flow over Elmwood Ave and Pleasant Street and flood a number of cellars.

Remarks and Recommendations Known as 30 Acre Pond Dam Area of Spillways ample for all natural flow. Dam breakage above would destroy this dam if full at the time.

Unchanged Sept. 1938 Unchanged Aug. 1940. Some leakage as shown-generally fair shape Feb. 1942. Good condition - unchanged May 1944. No change Sept. 1946. Missing round section Spillway walls. Feb. 1948 new intermed. remedied Nov. 194 Sound & fair shape Nov. 1950. Sound May 1951. Some no change July 1952. Sound - heavy flow Fe Good some seepage Dec. 1954. Good - no changes Sept. 1956. Good Oct. 1957. Spillboard of spillway - fair enough Sept. 1958. Good condition Oct. 1960. Good Oct. 1962. Good - no change Oct. 1964 Good - no change Dec. 1966. Good - new conc. floor Oct. 1968. Good - no change Good - no change Oct. 1969

INSPECTION REPORT - DAMS AND RESERVOIRS (136)

1. Location: City/~~Town~~ BROCKTON Dam No. 7-12-44-6

Name of Dam THIRTY ACRE POND Inspected by: A. DUGAN

Date of Inspection 12-5-72

2. Owner/s: Per: Assessors X Prev. Inspection 12-8-70

Reg. of Deeds _____ Pers. Contact X

1 CITY OF BROCKTON, CITY HALL, BROCKTON, MASS, ZIP 02401
Name St.& No. City/Town State Tel.No.

Name St.& No. City/Town State Tel.No.

Name St.& No. City/Town State Tel.No.

3. Caretaker:(if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

PARK SUPT.
Name St.& No. City/Town State Tel.No.

4. No. of Pictures taken NONE

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate _____

3. Severe X 4. Disastrous _____

*This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual X

Operative _____ yes; _____ No

Comments: _____

7. Upstream Face of Dam: Condition:

Conditions:

1. Good _____ 2. Minor Repairs X

3. Major Repairs _____ 4. Urgent Repairs _____

Comments: TREES

Dam No. I-12-44-6

8. Downstream Face of Dam:
Condition: 1. Good _____ 2. Minor Repairs X
3. Major Repairs _____ 4. Urgent Repairs _____
Comments: SOME TREES

9. Emergency Spillway:
Condition: 1. Good X 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____
Comments: _____

10. Water Level at Time of Inspection:
2.4 ft. above _____. below X. top of dam _____
principal spillway X. other _____.

11. Summary of Deficiencies Noted:
Growth (Trees & Brush) on Embankment Yes
Animal Burrows & Washouts No
Damage to Slopes or Top of Dam No
Cracked or Damaged Masonry No
Evidence of Seepage No
Evidence of Piping No
Erosion No
Leaks No
Trash and/or Debris Impeding Flow No
Clogged or Blocked Spillway No
Other _____

12. Remarks & Recommendations: (Fully Explain)

NEW TOP SOIL PLACED AND SEEDED ON TOP OF DAM THIS YEAR.

ALSO NEW CONCRETE FRONT FACE TO PART OF DAMS NEAR SPILLWAYS.

13. Overall Condition:

1. Safe X
2. Minor Repairs Needed
3. Conditionally Safe - Major Repairs Needed
4. Unsafe
5. Reservoir Impoundment no Longer Exists (explain)

Recommend Removal from Inspection List

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town Brockton Dam No. 7-12-44-6

Name of Dam Thirty Acre Pond Inspected by: K.B. Harrison & C.C. Burgess

Date of Inspection: 6-26-75

2. Owner/s: Per: Assessors ✓ Prev. Inspection 12-8-72

Reg. of Deeds _____ Pers. Contact _____

1. City of Brockton, City Hall, Brockton Mass.
Name St. & No. City/Town State Tel. No.

Name St. & No. City/Town State Tel. No.

Name St. & No. City/Town State Tel. No.

3. Caretaker:(if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Park Supt.
Name St. & No. City/Town State Tel. No.

4. No. of Pictures taken: None

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate _____

3. Severe ✓ 4. Disastrous _____

*This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ✓

Operative ✓ Yes _____ No

Comments: Conc. Pipe w/ flashboards & twin 36" conc. outlet pipes

7. Upstream Face of Dam: Condition:

Conditions:

1. Good ✓ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments: Lined with trees, but do not recommend removal of same.

APPENDIX B-5

 Dam No. 7-12-44-6

8. Downstream Face of Dam:

Condition: 1. Good ✓ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments: Same as upstream face.

9. ~~Emergency~~ Overflow Spillway:

Condition: 1. Good ✓ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments: No water flowing over came this date.

10. Water Level at Time of Inspection:

2.3 ft. _____ above. ✓ below. _____ top of dam.

✓ principal spillway. _____ other.

11. Summary of Deficiencies Noted:

Growth (Trees & Brush) on Embankment Yes - quantities.

Animal Burrows & Washouts No

Damage to Slopes or Top of Dam _____

Cracked or Damaged Masonry _____

Evidence of Seepage _____

Evidence of Piping _____

Erosion _____

Leaks _____

Trash and/or Debris Impeding Flow No

Clogged or Blocked Spillway Yes - minor debris (old tree)

Other _____

12. Remarks & Recommendations (fully explain)

Dam has good width & height and is well maintained.

Both slopes are lined with trees, but do not recommend cutting same.

Minor debris (some small trees) in principal spillway.

13. Overall Conditions:

1. Safe ✓
2. Minor Repairs Needed
3. Conditionally Safe - Major Repairs Needed
4. Unsafe
5. Reservoir Impoundment no Longer Exists (explain)

Recommend Removal from Inspection List

DESCRIPTION OF DAM

DISTRICT 7

Submitted by K B Hacawar Dam No. 7-12-44-6

Date 7-31-75 City/~~Town~~ Brockton

Name of Dam Thirty Acre Pond

1. Location: Topo Sheet No. 32 D

Provide 8½" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year Built In the 40's Year/s of Subsequent Repairs 1972

3. Purpose of Dam: Water Supply _____ Recreational ✓

Irrigation _____ Other _____

4. Drainage Area: 7 Sq.Mi. _____ Acres

5. Normal Ponding Area: _____ Acres _____ Ave.Depth

Impoundment: 60,000,000 Gals. _____ Acre Ft.

6. No. and Type of Dwellings Located Adjacent to Pond or Reservoir

i.e. Summer Homes, etc. None

7. Dimensions of Dam: Length 660' Max. Height 10'

Slopes: Upstream Face Mostly Vertical

Downstream Face Varied 14'-20' wide

Width Across Top 18'+

8. Classification of Dam by Material:

Earth ✓ Conc. Masonry ✓ Stone Mason. ✓

Timber _____ Rockfill _____ Other _____

DAM NO. 7-12-44-6

9. A. Description of Present Land Usage Downstream of Dam:

0 % rural 100 % urban

B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure _____ yes probably no?

10. Risk to Life and Property in Event of Complete Failure

No. of People _____
No. of Homes _____
No. of Businesses _____
} Numerous (probably)

No. of Industries _____ Type _____

No. of Utilities 4 Type Gas, Water, Tel & Elect.

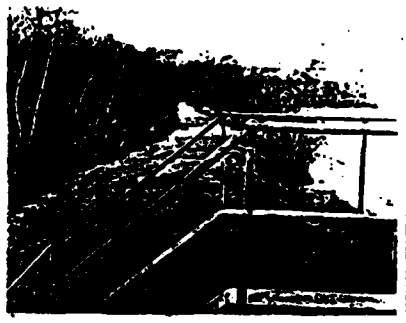
Railroads 0

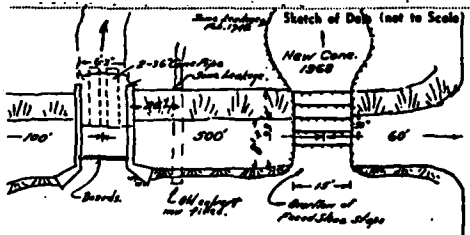
Other Dams 7-12-44-405

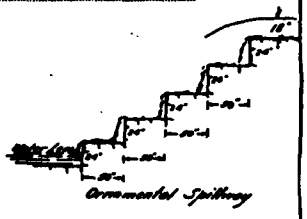
Other Center of City.

11. Attach sketch of dam to this form showing section and plan on an 8½" x 11" sheet.

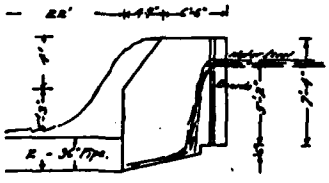
DAM NO 136

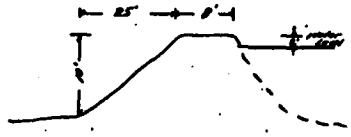




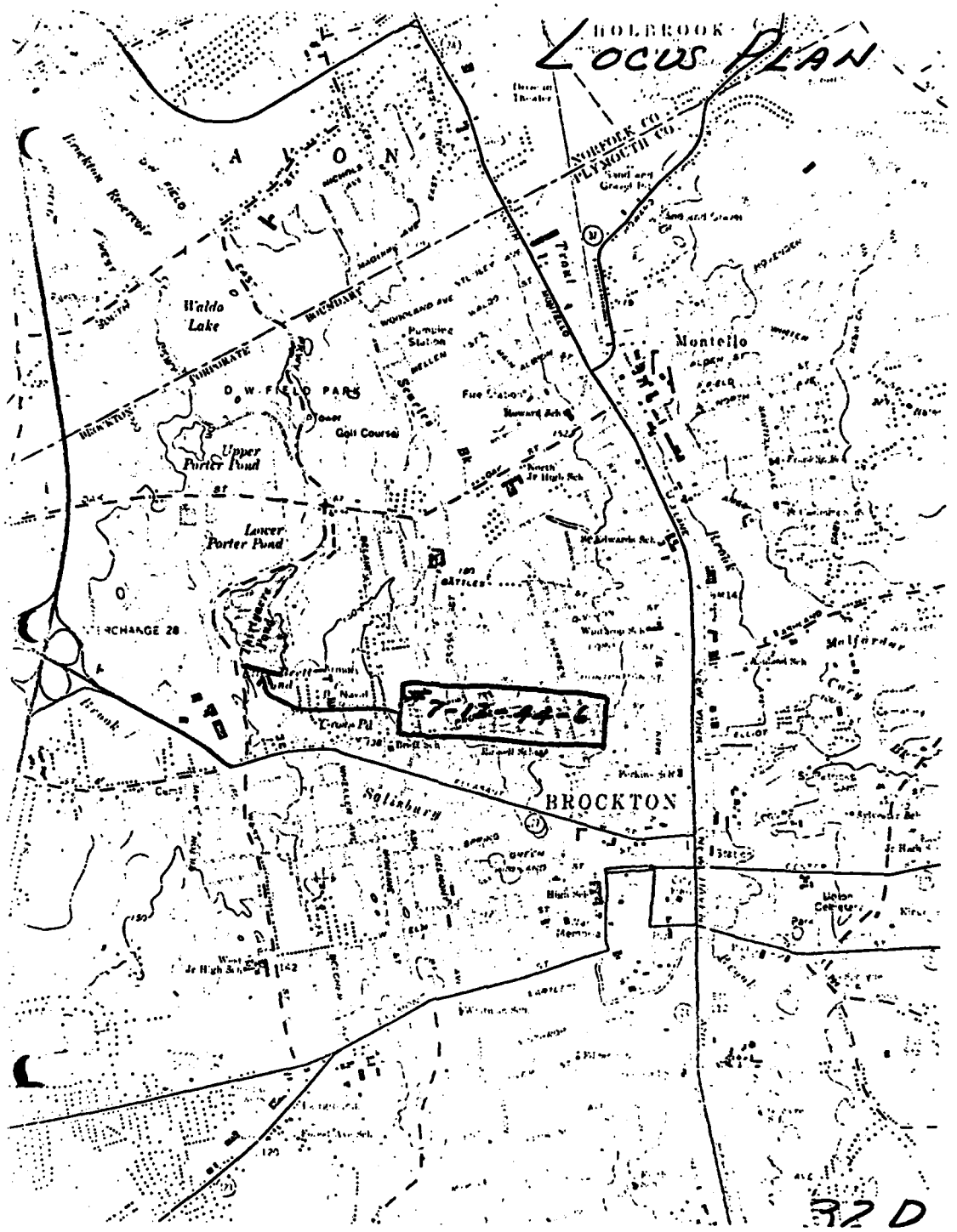


30 Acre Pond





APPENDIX B-10



APPENDIX B-11

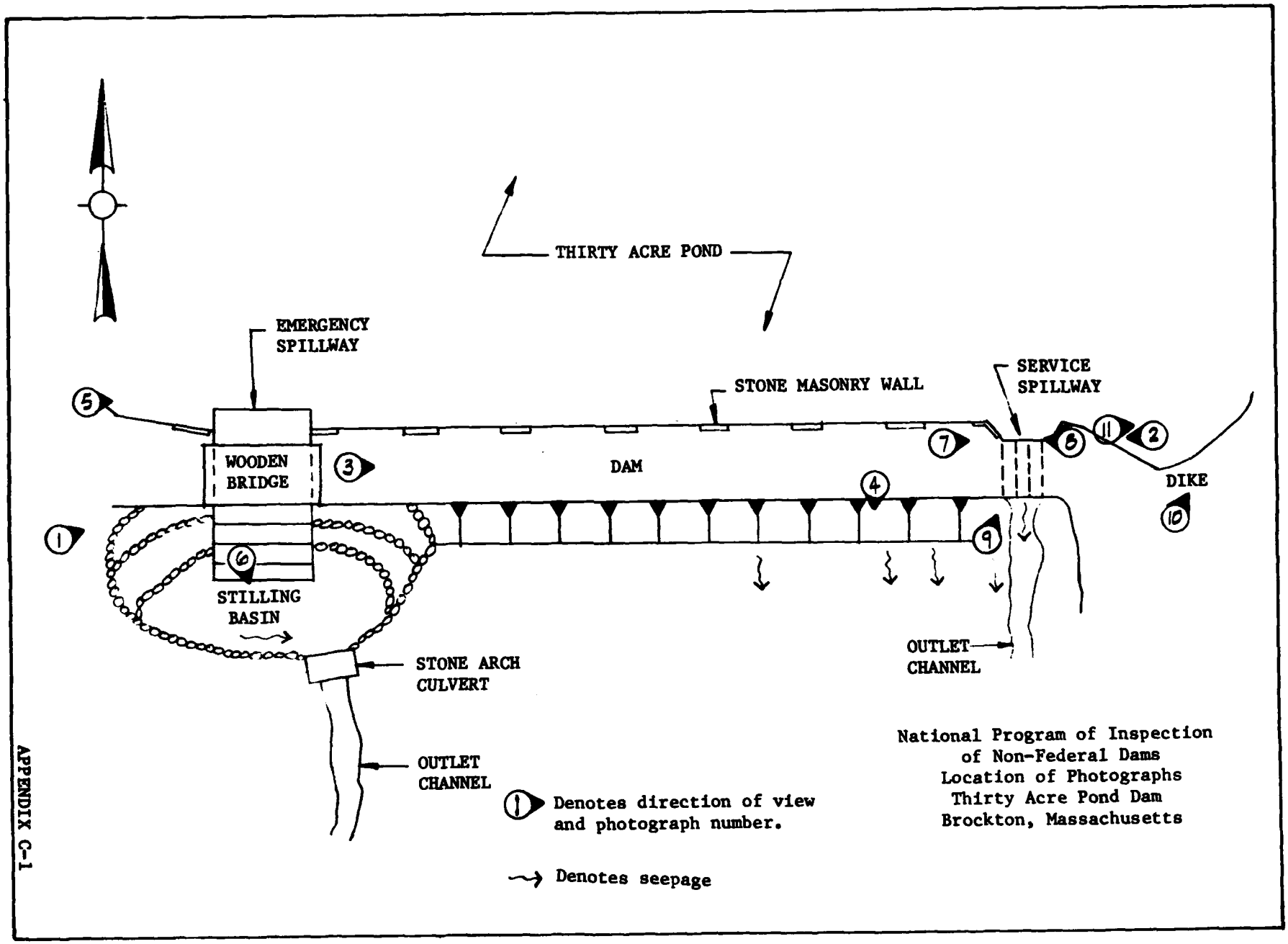
APPENDIX C

SELECTED PHOTOGRAPHS OF PROJECT

LOCATION PLAN	Page No.
Location of Photographs	C-1

PHOTOGRAPHS

No.	Title	Page No.
1.	Overview of Dam from Right Abutment	iv
2.	Overview of Dam from Left Abutment	iv
3.	Crest of Dam Looking East	C-2
4.	Downstream Toe of Dam in Seepage Area	C-2
5.	Upstream Side of Emergency Spillway	C-3
6.	Pool at Base of Emergency Spillway	C-3
7.	Entrance of Service Spillway	C-4
8.	Intake Chamber of Service Spillway	C-4
9.	Outlet of Service Spillway	C-5
10.	Crest of Low Dike Left of Dam	C-5
11.	Upstream Slope of Low Dike	C-6



National Program of Inspection of Non-Federal Dams
Location of Photographs
Thirty Acre Pond Dam
Brockton, Massachusetts

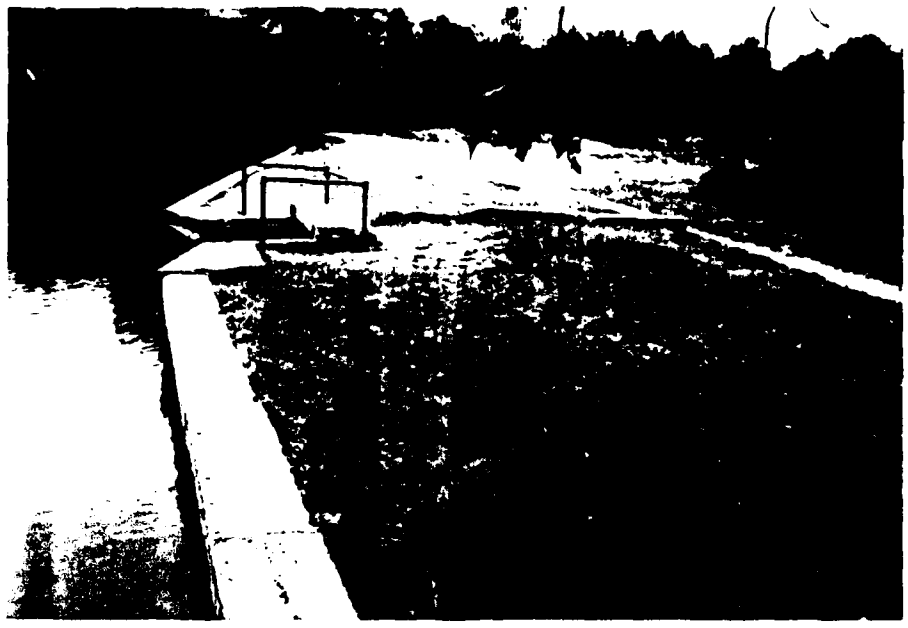
APPENDIX C-1

3. Crest of dam looking east.

4. Downstream toe of dam in seepage area.

5. Upstream side of emergency spillway.

6. Pool at base of emergency spillway.

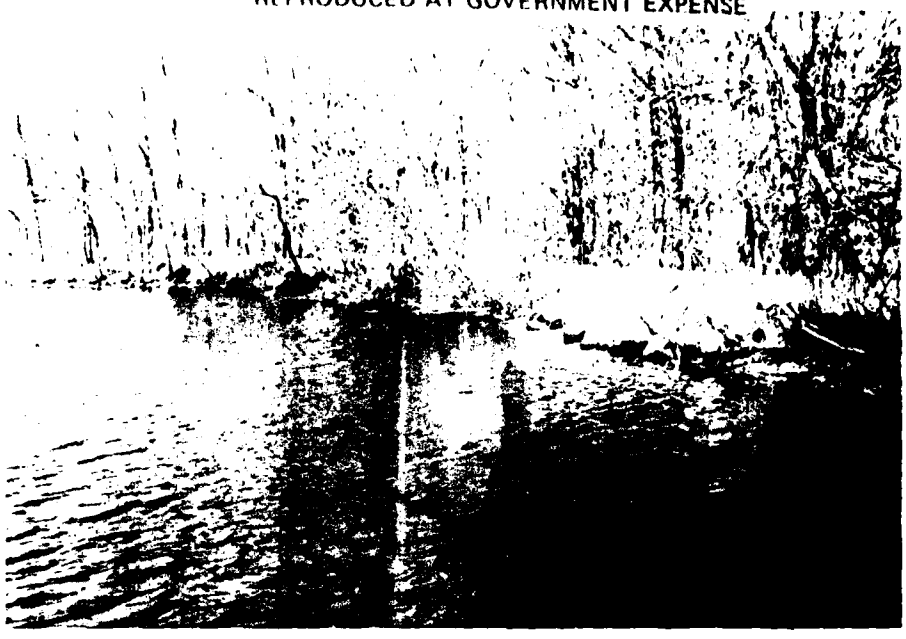


7. Entrance of service spillway.

8. Intake chamber of service spillway.

9. Outlet of service spillway. Seepage between pipes and at left foreground of picture.

10. Crest of low dike left of dam.

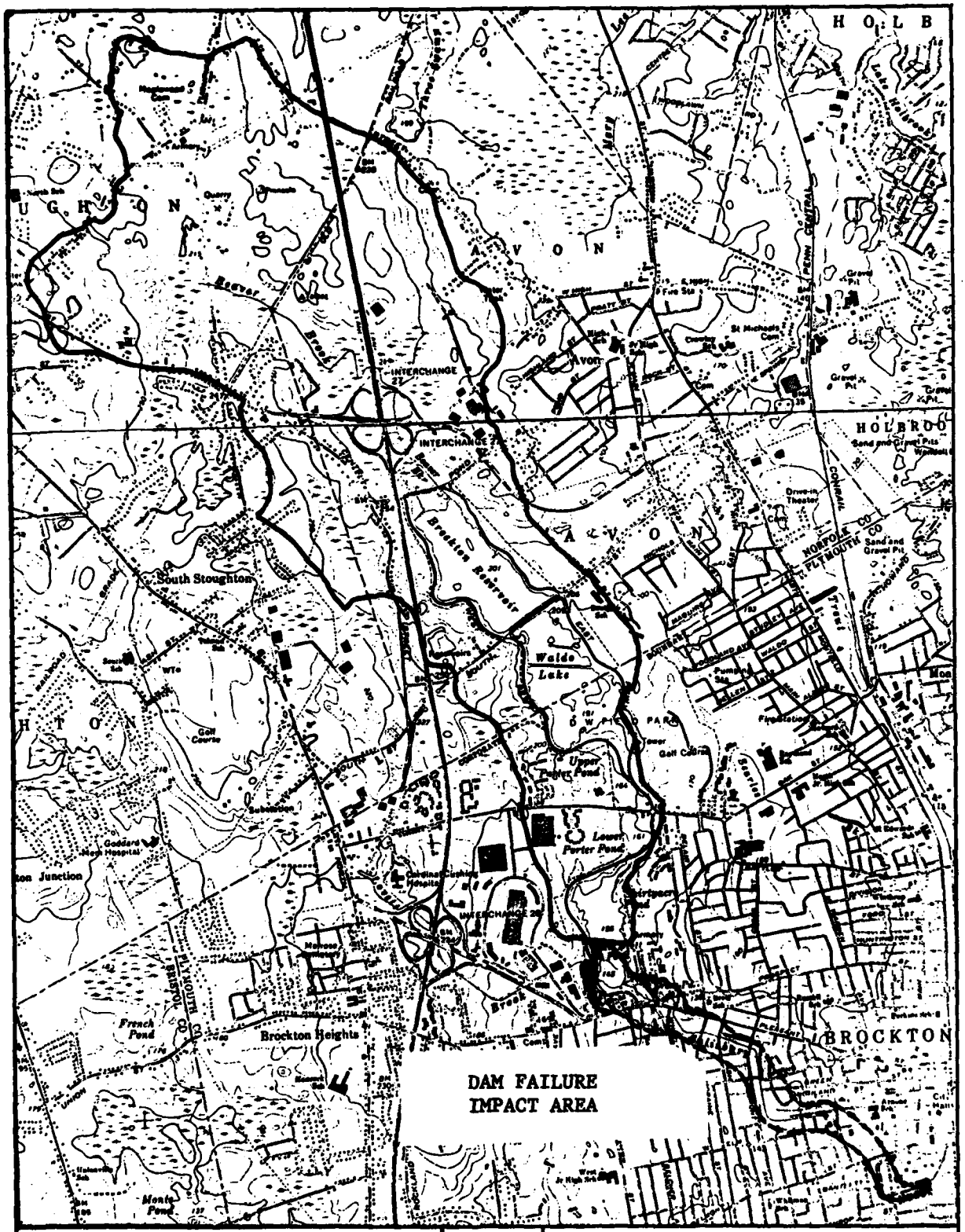


11. Upstream slope of low dike.

APPENDIX D

OUTLINE OF DRAINAGE AREA AND HYDRAULIC COMPUTATIONS

	Page No.
OUTLINE OF DRAINAGE AREA	
Drainage Area Map	D-1
COMPUTATIONS	
Size & Hazard Classification; Test Flood Determination	D-2
Dam Failure Analysis	D-3 - D-7
Computation of Test Flood (PMF)	
1. Brockton Reservoir Inflow	D-8 - D-11
2. Waldo Lake Inflow	D-12 - D-17
3. Thirty Acre Pond Inflow	D-18 - D-23
4. Thirty Acre Pond Outflow including the Outlet Rating Curve	D-24 - D-29
Supplemental Dam Failure Analysis	D-30



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Consulting Engineers
Boston, Massachusetts 02108

THIRTY ACRE POND DAM
Drainage Area Map and
Dam Failure Impact Area

APPROX. SCALE: 1" = 3077'

APPENDIX D-1

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT COE NIOT
PROJECT Thirtyacre Pond
DETAIL Hydraulics / Hydrology

JOB NO. 3905-15
DATE CHECKED 8/29
CHECKED BY Chandler

PAGE 1 of 27
DATE 2/15/79
COMPUTED BY

SCS Classification

Spillway Crest : Elev. 155 msl
Top of Dam : Elev. 160.5 msl
Downstream Toe of Dam : Elev. 147.5 msl
at Main Spillway

Height of Dam = 13.0 ft.

Storage Capacity =

At Elev. 155; Surface Area = 25.7 A

At Elev. 160.5; Surface Area = 36 A

$$\text{Storage} = \frac{1}{3} \times 25.7 \times 7.5 + \left(\frac{25.7+36}{2}\right) 5.50$$

$$= 233.9 \text{ Ac-ft.}$$

So, Size Category is SMALL

Hazard Classification

HIGH

Test Flood

½ PMF to PMF

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Environmental Engineers
Boston, Mass.

CLIENT COE NEDT JOB NO. 350-5-15 PAGE 20F27
PROJECT Thirdyear Pond DATE CHECKED 4-20-79 DATE 2/20/79
DETAIL Hydraulics / Hydrology CHECKED BY [illegible] COMPUTED BY

Dam Failure Analysis

Total Length of Dam: ~ 600 ft.

$Q_{P_1} = \frac{8}{27} W_b \sqrt{g} Y_o^{3/2}$

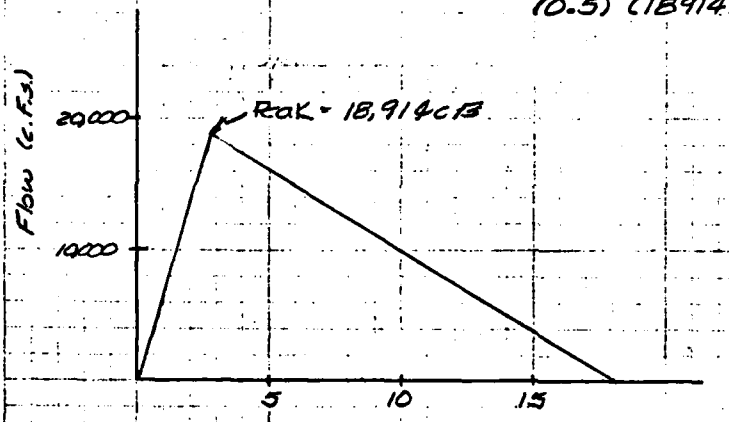
$W_b = 240$ ft.
$Y_o = 13.0$ ft.

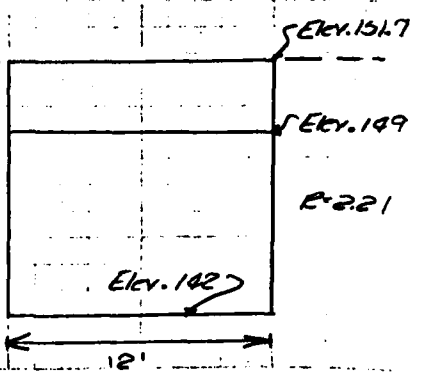
$\therefore Q_{P_1} = \frac{8}{27} \times 240 \times \sqrt{32.2} \times (13.0)^{3/2}$

$= 18,914$ cfs , $5 \neq 234$ Acre-ft $= 10193040$ ft³

Reach No. 1: Ellis Brett Pond

Duration of Failure Flow: $\frac{10,193,040 \text{ ft}^3}{(0.5)(18914 \text{ cfs})} \approx 1078$ sec. $\approx$ 18 min





Outlet Works

Spillway Crest = 142'
Top of Dam = 151.7'
Crown of Spillway = 149'
Structure

Dam Failure Analysis (cont.)

Outlet Rating Curve (Ellis Brett Pond)

Elev. W.S. (Ft.)	Head on Spillway	"C" Value	Q (cfs)
142	0		0
143	1	3.54	43
144	2	3.50	119
145	3	3.27	209
146	4	3.25	312
147	5	3.25	436
148	6	3.25	573
149	7	3.25	722
150	8	0.81	546
151	9	0.81	772
151.7	(9.7)	0.81	897

Note: "C" Value obtained from King and Brater Handbook of Hydraulics; Fig 5-22

Generalized Estimate of Reservoir Outflows
Fair and Geyer, pg. 207

Ratio of Storage Above Spillway Level to Flood Flow

Flood Flow = 10,193,040 ft³

Storage Above Spillway Level to Flood Flow = $\left(\frac{3^{A} + 23.6^{A}}{2}\right)$ 9.7 ft × 43,560 $\frac{A^{2}}{A}$

= 5,619,676 ft³

Ratio = $\frac{5,619,676 \text{ ft}^3}{10,193,040 \text{ ft}^3}$ = 0.55

∴ Ratio of Peak Outflow to Peak Inflow = 0.59

Peak Outflow from Ellis Brett Pond = 0.59 × 18914 = 11,159 cfs

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Boston, Mass.

CLIENT UDOT / COE
PROJECT Walsh Lake - Thirty Acre
DETAIL Hydraulics / Hydrology

JOB NO 380-5-15,16
DATE CHECKED 9-18-79
CHECKED BY [illegible]

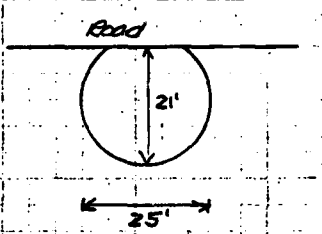
PAGE Next of 42
DATE 4/23/79
COMPUTED BY dlbd

REACH NO. 2
Cross Pond

Outlet Works

Circular Weir; Elev. 132.5 ft.
Top. of Road : Elev. 134.8 ft.

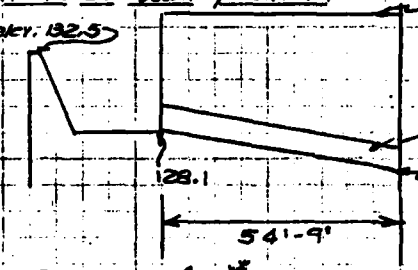
Plan View of Weir



Length = $\frac{\pi \times 25}{180} - 12.5 \times 99.3$ ft

= 18.45 ft * 58 feet

Profile of Weir / Culvert



Elev. W.S.	C* Value	Q
132.5		0
133.0	2.77	57
134.0	3.51	374
134.8	3.51	710
135.0	3.51	805

* King & Brater, Figure 5-9; Vertical upstream, 2:1 slope downstream face.

overland flow (290' length) = 45 cfs

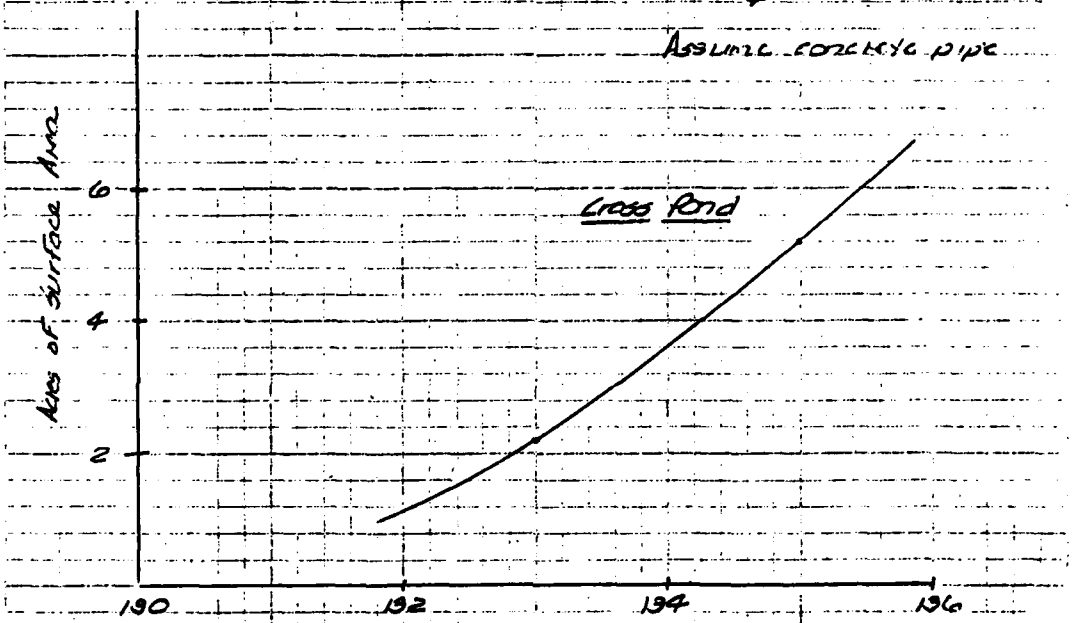
Culvert Capacity - Cross Road

Elev. W.S.	"C" Value	@ (cfs)
134.8	0.607	23
1350	0.607	23

Area of Culvert:

$\frac{\pi (1.5)^2}{4} = 1.77\ \square$

Assume concrete pipe



Generalized Estimate of Reservoir Outflows
Fair and Geyer, pg. 207

Ratio of Storage Above Spillway Level to Flood Flow

Flood Flow = $\frac{11,159}{18914} \times 10,193,040\ ft^3 = 6,013,754 ft^3$

Storage Above Spillway Level to Flood Flow : $\left(\frac{1.65A + 9.9A}{2}\right) 2.3\ Ft. \times 43,560 \frac{ft^2}{Acre}$

$= 328,116\ A^3$

CAMP DRESSER & McKEE INC. CLIENT COE/UDT JOB NO 390-5.15 PAGE 6 OF 27
PROJECT Thirlmere Road DATE CHECKED 6-30-80 DATE 5/1/79
DETAIL Hydraulics/Hydrology CHECKED BY [illegible] COMPUTED BY [illegible]

Storage = 329,116 A^3

Ratio : $\frac{328,116}{6,013,754}$ = .055

∴ Ratio of Peak Inflow to Peak Outflow = .988

Peak Outflow from Cross Road = 0.988 x 11,159 cfs = 11025 cfs

This flow would cause severe flooding throughout the downstream reaches of Salisbury Brook (downtown Brockton) to Grove Street.

APPENDIX D-7

Computation of Test Flood

Drainage Area to Brockton Reservoir = 1850 A

a. Times of Travel, Concentration, Lag

Overland : 4250 Ft.
Beaver Brook : 8900 Ft.
Total Length : 13,150 Ft.

Average Slope:

15 %	205'	≈ 1,970
85 %	260'	≈ 11,180

SLOPE = $\frac{55}{9210}$ = .00597 ≈ .59718 %

Curve No. Analysis ; Soil Group C

Land Use	Area	CN	CN x Area
Surface Water	81.0 A	100	8100
Paved Roads	65.1 A	98	6370
Wetlands	270 A	98	26460
Wooded Areas	1429 A	70	100030
	1850 A		141460

Weighted CN = 76.5 , S = 3.072

$$L = \frac{(13,150)^{0.8}\,(3.072+1)^{0.7}}{1900\,(.59718)^{0.5}}$$

L = 3.59 hours , say 3.60 hours

$T_C = \frac{3.60}{0.6}$ = 6 hours

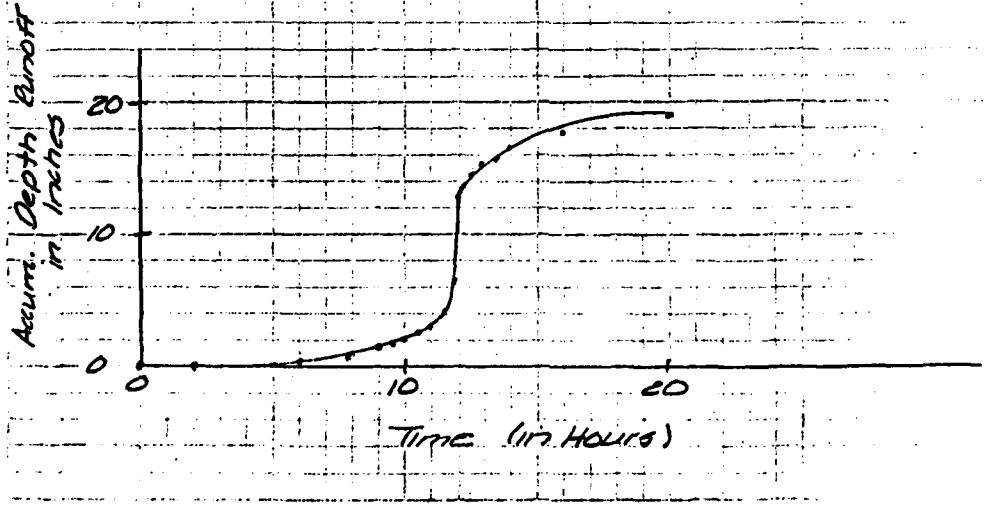
b. Test Flood = PMF for 6 hours

P = 24 inches in 6 hours

c. $\Delta D = 0.4L$
$= (0.4)(3.60) = 1.44$ hours

$T\Delta D \approx 10$ hours

Time (hours)	P_t/P_{24}	Mass P (inches)	Mass Q (inches)
0.0	0	0	0
2.0	.022	.53	.002
6.0	.080	1.92	.390
8.0	.120	2.88	.962
9.0	.147	3.53	1.420
9.5	.163	3.91	1.706
10.0	.181	4.34	2.042
10.5	.204	4.90	2.500
11.0	.235	5.64	3.119
11.5	.283	6.79	4.124
11.75	.387	9.29	6.407
12.0	.663	15.91	12.737
12.5	.735	17.64	14.423
13.0	.772	18.53	15.293
13.5	.799	19.18	15.930
14.0	.820	19.68	16.420
16.0	.880	21.12	17.834
20.0	.952	22.85	19.536



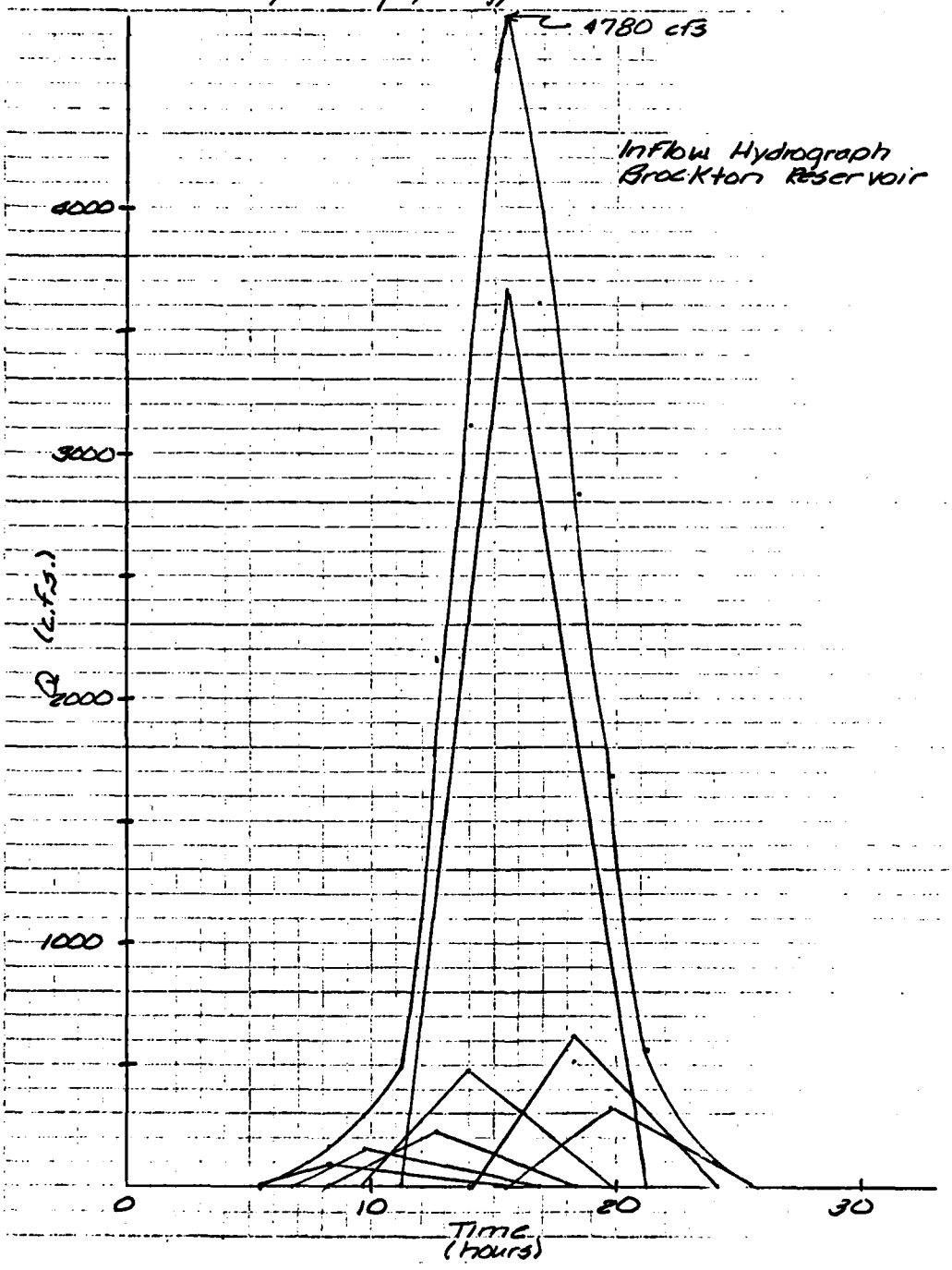
Start of Storm: 11.88 - 4.5 (1.44) = 5.4 hours

Increment	Time (hours)	Mass Runoff (inches)	ΔQ (inches)	Δq (cfs)	Y	YΔq (cfs)
	5.40	.330				
ΔQ_1			.300	97	0.2	19
	6.84	.630				
ΔQ_2			.960	149	0.4	60
	8.28	1.090				
ΔQ_3			.690	223	0.6	134
	9.72	1.780				
ΔQ_4			1.500	486	0.8	390
	11.16	3.280				
ΔQ_5			11.317	36604	1.0	36604
	12.60	14.597				
ΔQ_6			1.880	609	0.6667	406
	14.04	16.477				
ΔQ_7			0.989	320	0.333	107
	15.48	17.466				

9780 cfs

$$\Delta q_p = \frac{484 \times (7.89)}{\frac{1.44}{2} + 3.60} \Delta Q \quad \& \quad 324\, \Delta Q$$

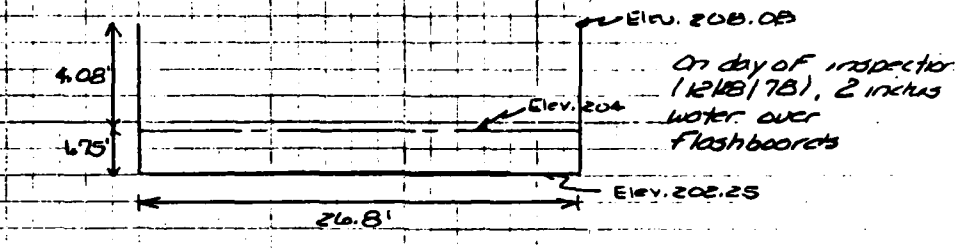
CAMP DRESSER & McKEE INC. CLIENT COE/NDT JOB NO. 380-5-15 PAGE 10 of 27
PROJECT Thirtyacre Pond DATE CHECKED [illegible] DATE 2/23/79
DETAIL Hydraulics/Hydrology CHECKED BY [illegible] COMPUTED BY dlbd



APPENDIX D-11

CAMP DRESSER & McKEE INC. CLIENT COE / NDI JOB NO. 380-5-15 PAGE 110F 27
PROJECT Thirtyacre Pond DATE CHECKED 2-28-79 DATE 2/23/79
DETAIL Hydraulics / Hydrology CHECKED BY [illegible] COMPUTED BY dlbd

Brockton Reservoir Outlet



Spillway Rating Curve

Sharp crested weir: L/b = 1.0
H = height water over weir
P = dist. from weir crest to weir base (vertical)

P = 1'9" (1.75')

Head (Ft.)	H/P	C (value)	Q*
0	0		0
1	.57	3.47	93
2	1.14	3.68	279
3	1.71	3.90	543
4	2.29	4.00	858
4.08	2.33	4.00	883

* with 1.75 Ft. of Flashboards installed.

Note: Top of Dam elevation = 208.08

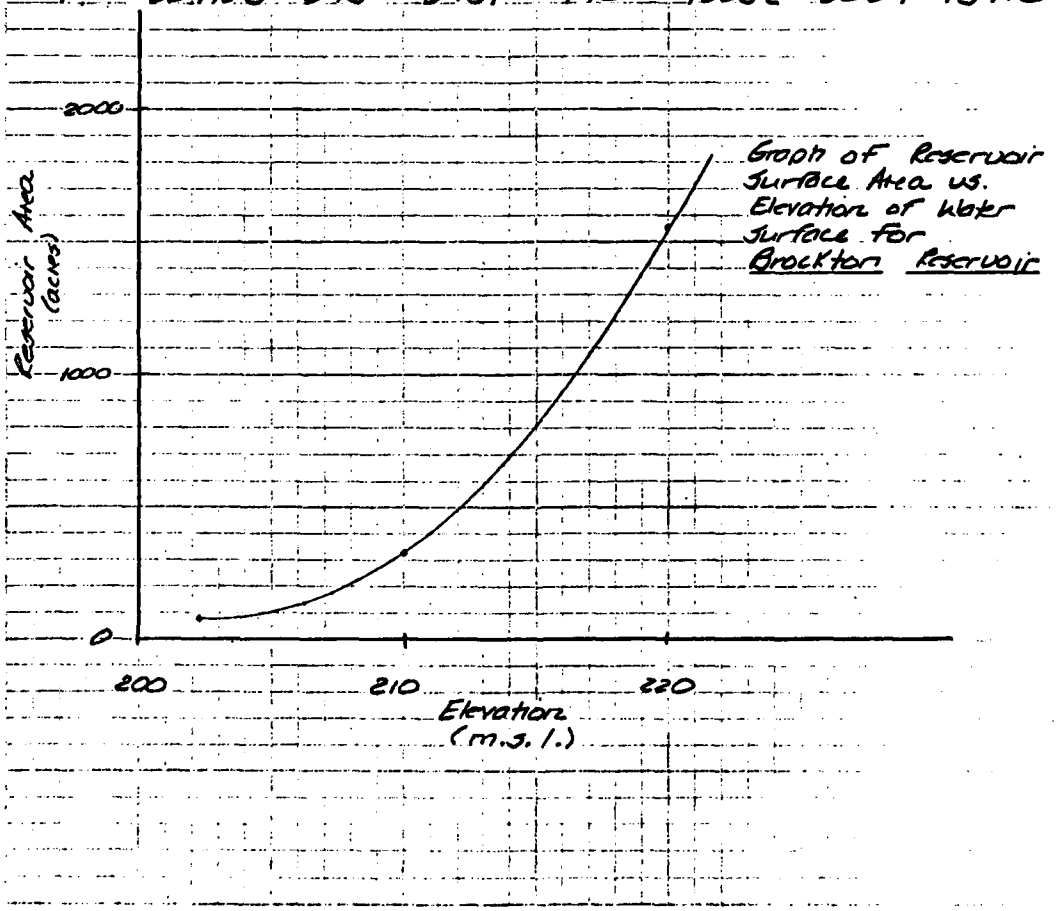
Head (Ft.)	H/P	C (value)	Q*
0		4.00	0
1			107
2			303
3			557
4			858
5			1199
5.83			1509
6			1576 + 263 = 1839
7			1985 + 4746 = 6731

* no flashboards in place P = 0

overland flow

CAMP DRESSER & McKEE INC. CLIENT COE / ILLOI JOB NO 390-5-15 PAGE 12 of 27
PROJECT Thirtyacre Pond DATE CHECKED [illegible] DATE 2/26/79
DETAIL Hydraulics / Hydrology CHECKED BY [illegible] COMPUTED BY dlbd

Head on Spillway	Elev. of W.S.	Res. Area (acres)	Calc. Outflow (cfs)	Calc. Storage (acre-ft)	$\frac{S}{\Delta t}$ (cfs)	$\frac{S}{\Delta t} - \frac{Q}{2}$ (cfs)	$\frac{S}{\Delta t} + \frac{Q}{2}$ (cfs)
0	202.25	87	0	0	0	0	0
1	203.25	90	107	89	1077	1024	1131
2	204.25	95	303	181	2190	2038	2341
3	205.25	105	557	281	3400	3122	3679
4	206.25	135	858	401	4852	4423	5281
5	207.25	175	1199	556	6728	6120	7327
5.83	208.08	210	1509	714	8661	7906	9415
6	208.25	215	1839	751	9087	8167	10006
7	209.25	275	6731	996	12052	8687	15418



APPENDIX D-13

CAMP DRESSER & McKEE INC. CLIENT COE MNOT JOB NO 380-5-15 PAGE 13 of 27

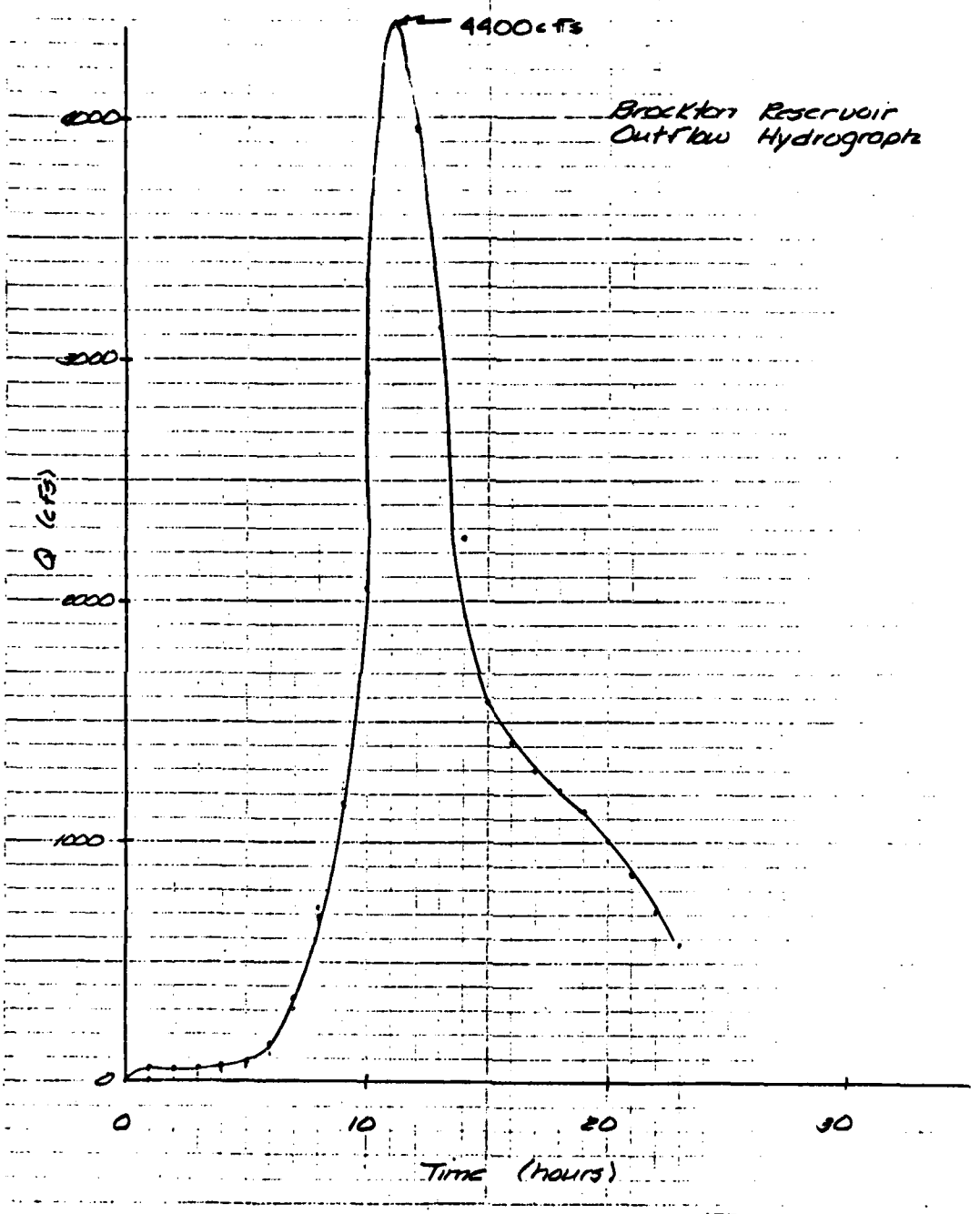
PROJECT Thirtyacre Pond DATE CHECKED [illegible] DATE 2/26/79

DETAIL Hydraulics/Hydrology CHECKED BY [illegible] COMPUTED BY dlbd

Calculation of Brockton Reservoir Outflows

Time Hr.	Obs. Inflow (cfs)	Aver. Inflow (cfs)	$\frac{S}{\Delta t} - \frac{O}{2}$	$\frac{S}{\Delta t} + \frac{O}{2}$	Head on Spillway (ft.)	Elev. of Wat. Surf. (ft.)	Outflow @ (cfs)
0	0	0	—			202.25	0
1	45	22	—	—	0.42	202.67	45
2	105	75	431	506	0.45	202.70	48
3	180	143	458	601	0.53	202.78	57
4	270	225	544	769	0.68	202.93	73
5	380	325	696	1021	0.90	203.15	97
6	725	552	925	1477	1.29	203.54	163
7	1700	1213	1314	2527	2.14	204.39	338
8	2750	2225	2189	4414	3.46	205.71	695
9	3960	3355	3719	7074	4.88	207.13	1157
10	4780	4370	5917	10227	6.04	208.29	2039
11	4250	4515	8188	12703	6.50	208.77	4277
12	3550	3900	8426	12326	6.93	208.68	3946
13	2590	3045	8340	11435	6.26	208.51	3131
14	1800	2170	8304	10974	6.09	208.34	2262
15	900	1350	8212	9562	5.87	208.12	1591
16	460	680	7971	8651	5.57	207.82	1411
17	280	370	7444	7814	5.28	207.53	1303
18	160	220	6938	7158	5.05	207.30	1219
19	60	110	6542	6652	4.79	207.04	1129
20	0	30	6034	6064	4.45	206.70	1013
21	0	0	5343	5343	4.04	206.29	870
22	0	0	4496	4496	3.51	205.76	711
23	0	0	3785	3785	3.07	205.32	577

CAMP DRESSER & MCKEE INC. CLIENT COE NAD JOB NO 390-5-15 PAGE 14 of 27
PROJECT Thirlmere Road DATE CHECKED [illegible] DATE 5/23/79
DETAIL Hydraulics/Hydrology CHECKED BY [illegible] COMPUTED BY dlbd



APPENDIX D-15

CAMP DRESSER & MCKEE INC. CLIENT COE/IIDOT JOB NO 380-5-15 PAGE 15 of 27
PROJECT Thirtyacre Road DATE CHECKED 6-30-79 DATE 2/23/79
DETAIL Hydraulics/Hydrology CHECKED BY [illegible] COMPUTED BY dlbd

Waldo Lake Inflow

Additional Drainage Area = 228 Acres

1) Peak Flow Determination from 228 Acres

$$\frac{Q_1}{Q_2} = \frac{A_1^{\left(\frac{.896}{A_1^{.316}}-1\right)}}{A_2^{\left(\frac{.896}{A_1^{.316}}-1\right)}}$$

$Q_1 = 1400 \text{ cfs} / 2.89 \text{ sq. mi.} = 1522 \text{ CSM}$

$A_1 = 2.89$ sq. mi.
$A_2 = 0.36$ sq. mi.

$$\therefore Q_2 = \frac{1522 \text{ CSM}}{\frac{2.89^{-.15}}{.36^{-.061}}} = 1900 \text{ CSM}$$

$Q_2 = 684$ c.f.s

2) Find Tp

Length = 1800 ft.
Slope = 0.030
Velocity = .93 $\sqrt{S}$ (SCS - Section 4 - Figure 15.2)

$T_c = 1800 / 0.93 = 1936$ sec = 1.16 hours

Lag = 0.6 T_c = 0.70 hours
$\Delta D = 0.4 L = 0.4 \times 1.70 = 0.28$ hours

$$\therefore Tp = \frac{.28}{2} + 0.70 = 0.84 \text{ hours}$$

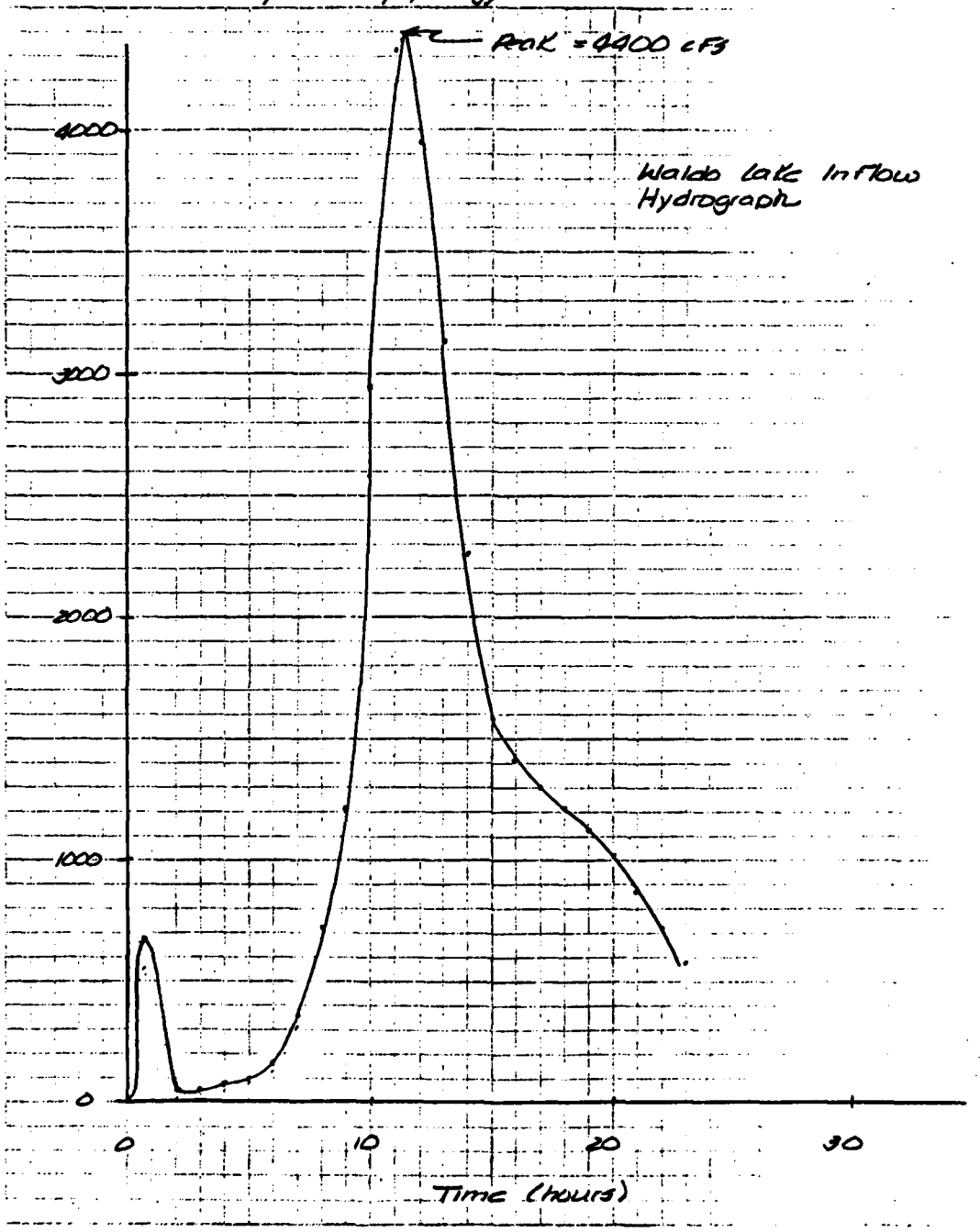
Resulting Inflow Hydrograph into Waldo Lake is on following page

CAMP DRESSER & McKEE INC.

CLIENT COE/WDOT JOB NO 290-5-15 PAGE 16 of 27

PROJECT Thirtyacre Road DATE CHECKED [illegible] DATE 2/23/79

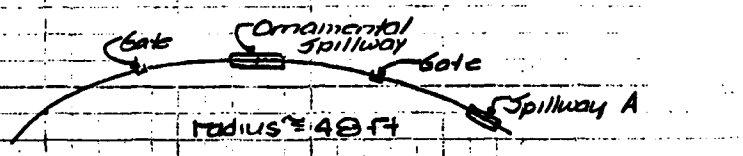
DETAIL Hydraulics / Hydrology CHECKED BY [illegible] COMPUTED BY dlbd



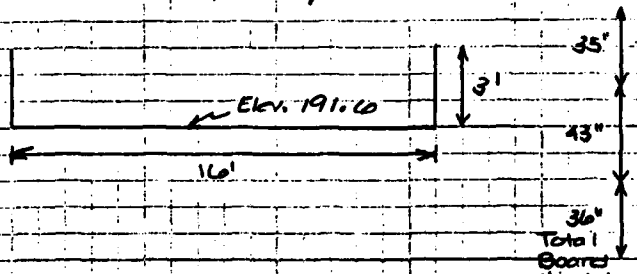
APPENDIX D-17

CAMP DRESSER & MCKEE INC. CLIENT COE MVDT JOB NO 380-5-15 PAGE 17 of 27
PROJECT Thidvacca Pond DATE CHECKED [illegible] DATE 2/23/79
DETAIL Hydraulics / Hydrology CHECKED BY [illegible] COMPUTED BY dlbd

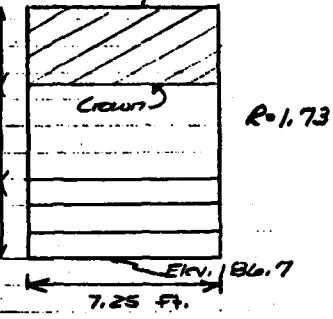
Waldo Lake Outlet Structures



Ornamental Spillway (0.3)



Spillway A



Assume flashboards are removed

Elevation W.S.	C_A 5-23	Q_A	C_{OS} 5-22	Q_{OS}	Q_{TOTAL}
186.7	—	0	—	—	0
187	3.13	4	—	—	4
188	3.11	33	—	—	33
189	3.17	80	—	—	80
190	3.29	143	—	—	143
191	3.37	218	—	—	218
191.6	3.37	265	—	—	265
193	3.37	386	3.55	94	480
193.3	3.37	414	3.53	125	539
199.6	0.81	356	3.27	272	628

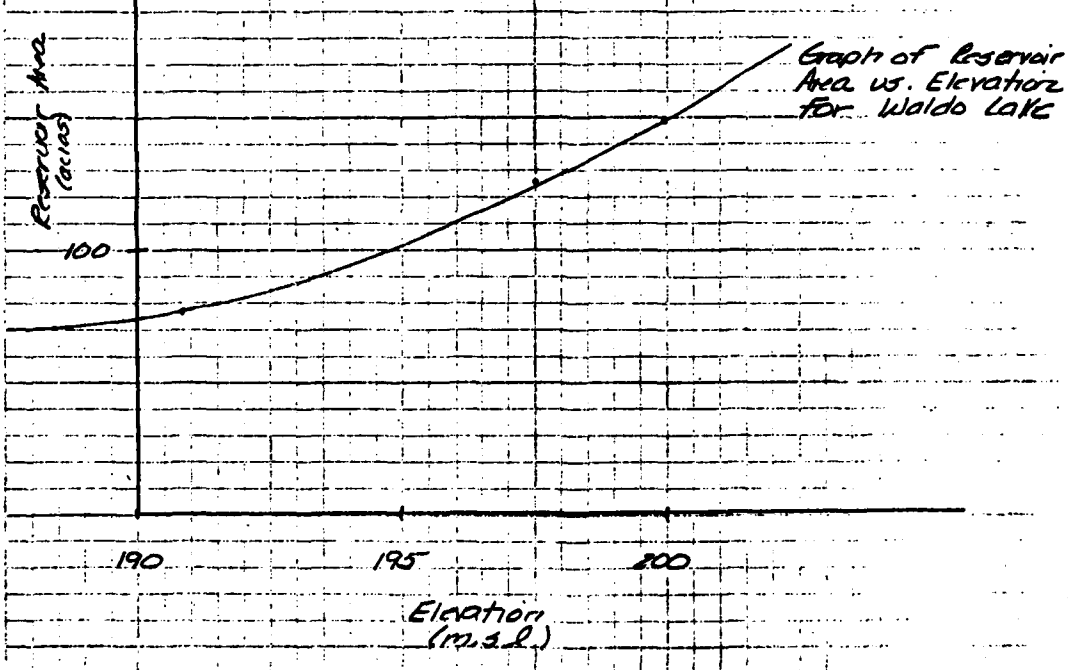
Assume Flow through 196.0 Trans. Boxes ; A = 17.5, WP = 17, R = 1.0294, L = 62 feet, C = 0.82

$Q = .82 \times (17.5 \times 2) \sqrt{60.4 \times 23}$
$= 702$ cfs

CAMP DRESSER & MCKEE INC. CLIENT COE, LIVDI JOB NO. 380-5-15 PAGE 19 OF 27
PROJECT Thirtyacre Pond DATE CHECKED [illegible] DATE 2/23/79
DETAIL Hydraulics / Hydrology CHECKED BY [illegible] COMPUTED BY dlbd

Functional Rates of Storage

Elev. of W.S.	Res. Area (acres)	Lake Outflow Q (cfs)	Lak. S (acre-ft)	$\frac{S}{\Delta t}$	$\frac{S}{\Delta t} - \frac{Q}{2}$	$\frac{S}{\Delta t} + \frac{Q}{2}$
1867	70	0	0	0	0	0
188	70.5	33	91	1101	1085	1118
189	72	80	162	1960	1920	2000
190	74	193	235	2844	2773	2916
191	78	218	311	3763	3654	3872
193	87	480	476	5760	5520	6000
194.6	98	628	624	7550	7236	7864
196.C	110	746	770	9317	8944	9690
197.0	118	781	884	10696	10306	11087
197.5	126	798	945	11435	11036	11834
198.0	128	1079	1008	12197	11657	12736
200.0 200	150	3892	1286	15567	13646	17488

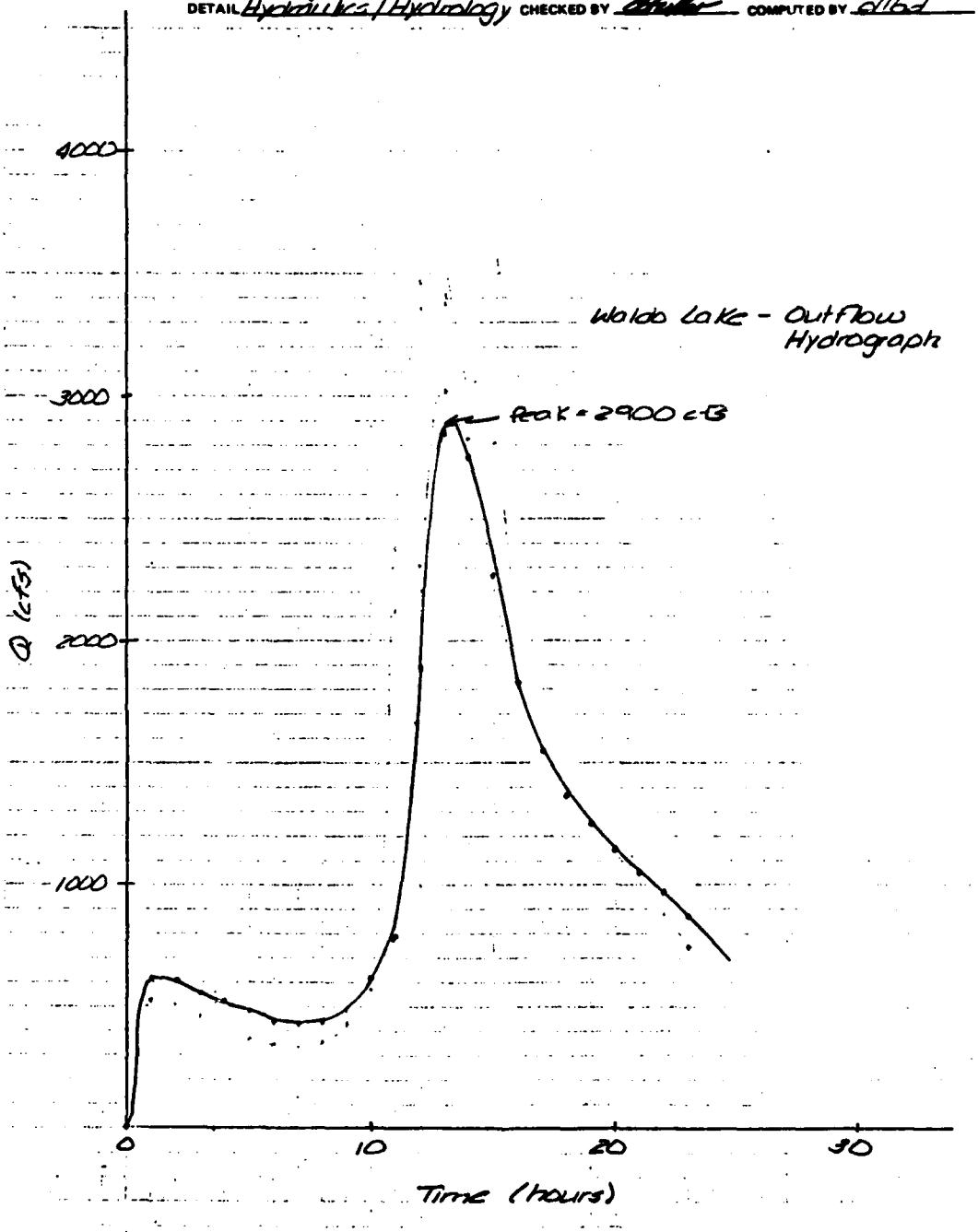


Graph of Reservoir Area vs. Elevation for Waldo Lake

CAMP DRESSER & McKEE INC. CLIENT ELLIOT JOB NO 390-5-15 PAGE 19 OF 27
PROJECT Thirteenth Pond DATE CHECKED [illegible] DATE 2/23/79
DETAIL Hydraulics / Hydrology CHECKED BY [illegible] COMPUTED BY dlbd

Time No.	Obs. Inflow (cfs)	Avg Inflow (cfs)	$\frac{\Delta t}{\Delta t} - \frac{Q}{2}$ (cfs)	$\frac{\Delta t}{\Delta t} + \frac{Q}{2}$ (cfs)	Head (on 1866.7) (ft.)	Elev. W.S. (ft.)	Q Outflow (cfs)
0	0	0					0
1	620	310			7.81	194.51	620
2	48	334	7143	7477	7.57	194.27	597
3	57	53	6880	6933	7.10	193.80	554
4	73	65	6379	6444	6.68	193.38	515
5	97	85	5929	6014	6.31	193.01	481
6	166	132	5533	5665	5.99	192.69	439
7	359	260	5226	5486	5.82	192.52	417
8	717	536	5069	5605	5.93	192.63	431
9	1220	969	5174	6143	6.92	193.12	991
10	2944	2082	5652	7734	7.79	194.99	618
11	4383	3664	7116	10780	10.08	196.78	773
12	3946	4136	10007	14143	11.89	198.59	1897
13	3131	3537	12246	15783	12.58	199.28	2851
14	2262	2697	12932	15629	12.52	199.22	2761
15	1591	1927	12868	14795	12.17	198.87	2276
16	1411	1501	12519	14020	11.84	198.54	1826
17	1303	1357	12194	13551	11.64	198.34	1553
18	1219	1261	11998	13259	11.52	198.22	1383
19	1129	1174	11150	12329	11.43	198.13	1262
20	1013	1071	11062	12133	11.35	198.05	1151
21	870	942	10982	11924	11.25	197.95	1053
22	711	791	10871	11662	11.11	197.81	972
23	577	644	10690	11334	10.93	197.63	871

CAMP DRESSER & McKEE INC. CLIENT CDF HUNT JOB NO. 330-5-15 PAGE 20 of 27
PROJECT Thirtyacre Road DATE CHECKED [illegible] DATE 2/28/79
DETAIL Hydraulics / Hydrology CHECKED BY [illegible] COMPUTED BY Allbd



APPENDIX D-21

Thirty Acre Pond Inflow

Additional Drainage Area = 228 Acres

1. Peak Flow Determination From 228 Acres

$$\frac{Q_1}{Q_2} = \frac{A_1\left(\frac{.894}{A_1^{.010}} - 1\right)}{A_2\left(\frac{.894}{A_2^{.010}} - 1\right)}$$

$Q_1 = \frac{2900 \text{ cfs}}{3.25 \text{ sq. mi.}} = 892 \text{ CSM}$

$A_1 = 3.25$ sq. mi.
$A_2 = .36$ sq. mi.

$Q_2 = \frac{892 \text{ CSM}}{\frac{3.25^{-.155}}{3.61^{-.1594}}} = 1873 \text{ CSM}$

$Q_2 = 3150 \text{ cfs}$ ($Q_1 = 314$ cfs)

2. Find T_p.

Length = 2800 ft.
Slope = .0232
Velocity = .38 ft/s

$Time_c = 2.05$ hours

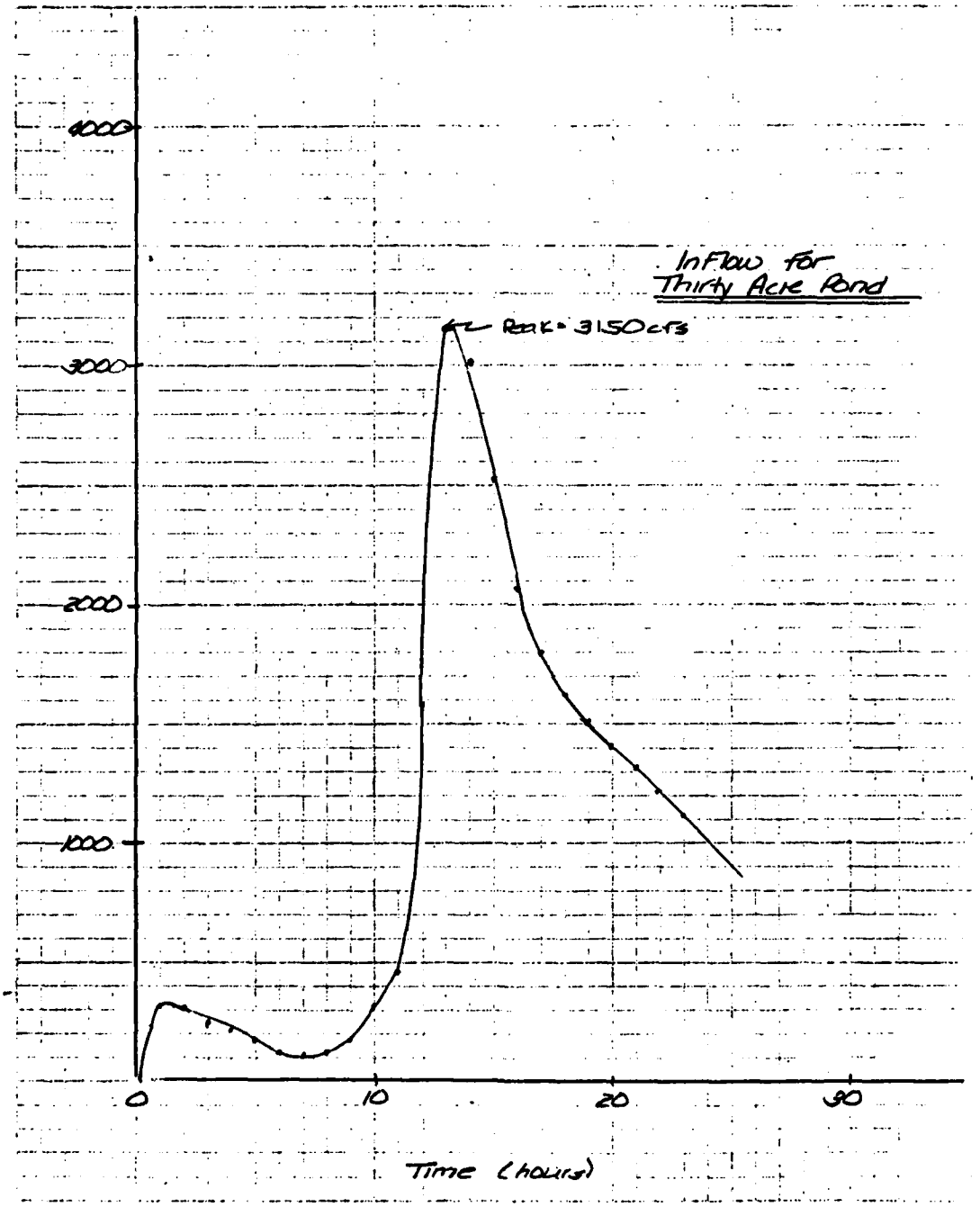
Lag = $0.6\ T_c = 0.6 \times 2.05 = 1.23$ hours

$\Delta D = 0.4\ L = 0.4 \times 1.23 = 0.49$ hours

$T_p = 1.23 + \frac{0.49}{2} = 1.48$ hours

Composite Hydrograph on following page.

CAMP DRESSER & MCKEE INC. CLIENT COE/ILLOI JOB NO 330-5-15 PAGE 22 of 27
PROJECT Thirtyacre Pond DATE CHECKED 2/28/79 DATE 2/28/79
DETAIL Hydraulics/Hydrology CHECKED BY [illegible] COMPUTED BY dlbd

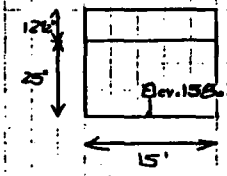


APPENDIX D-23

Thirty Acre Pond

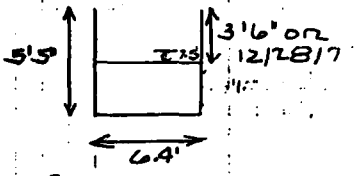
Outlet Works.

a Ornamental Spillway



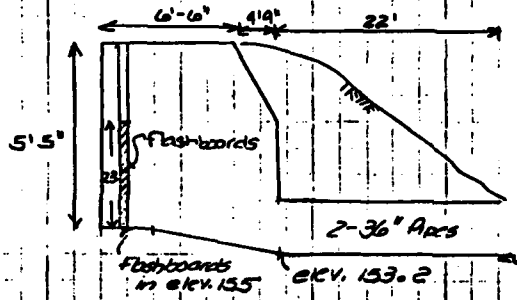
Elevation of Crest: 158.2
Top of Dam: 160.5

b. Main Spillway



Elevation of Crest = 155

Main Spillway Profile



Main Spillway Rating Curve

Elev. W.S.	Head on Spillway	"C" Value	Q (cfs)
155	0		0
156	1	3.54	23
157	2	3.50	63
158	3	3.27	109
159	4	3.25	166
160	5	3.25	233
160.5	5.5	3.25	268
161	6	3.25	306
162	7	3.25	385
163	8	3.25	471

King & Brater: Figure 5-22

Note: Dam Length = 592 Ft
Dike " = 300 Ft.

Twin 36" ϕ Concrete Pipe Capacities

Elev. W.S.	Head on Culvert	"C" Value	Q (cfs)	
156.1	0	—	90	flowing full
157.1	1	.90	102	
158.1	2		144	
159.1	3		177	
160.1	4		204	
161.1	5		228	+ 2.5 x 0.5$^{3/2}$ x 877 = 1000
162.1	6		250	+ 2.5+1.5$^{3/2}$ x 877 = 1280
163.1	7	↓	271	+ 2.5+2.5$^{3/2}$ x 877 = 8940

Ornamental Spillway Rating Curve

King and Brater ; Fig 5-12

Elev. W.S.	Head on Spillway	"C" Value	Q (cfs)
158.2	0		0
159	0.8	3.50	38
160	1.8	3.37	122
160.5	2.3	3.32	174
161	2.8	3.32	293
162	3.8	3.37	374
163	4.8	3.38	533

Total Spillway Capacities

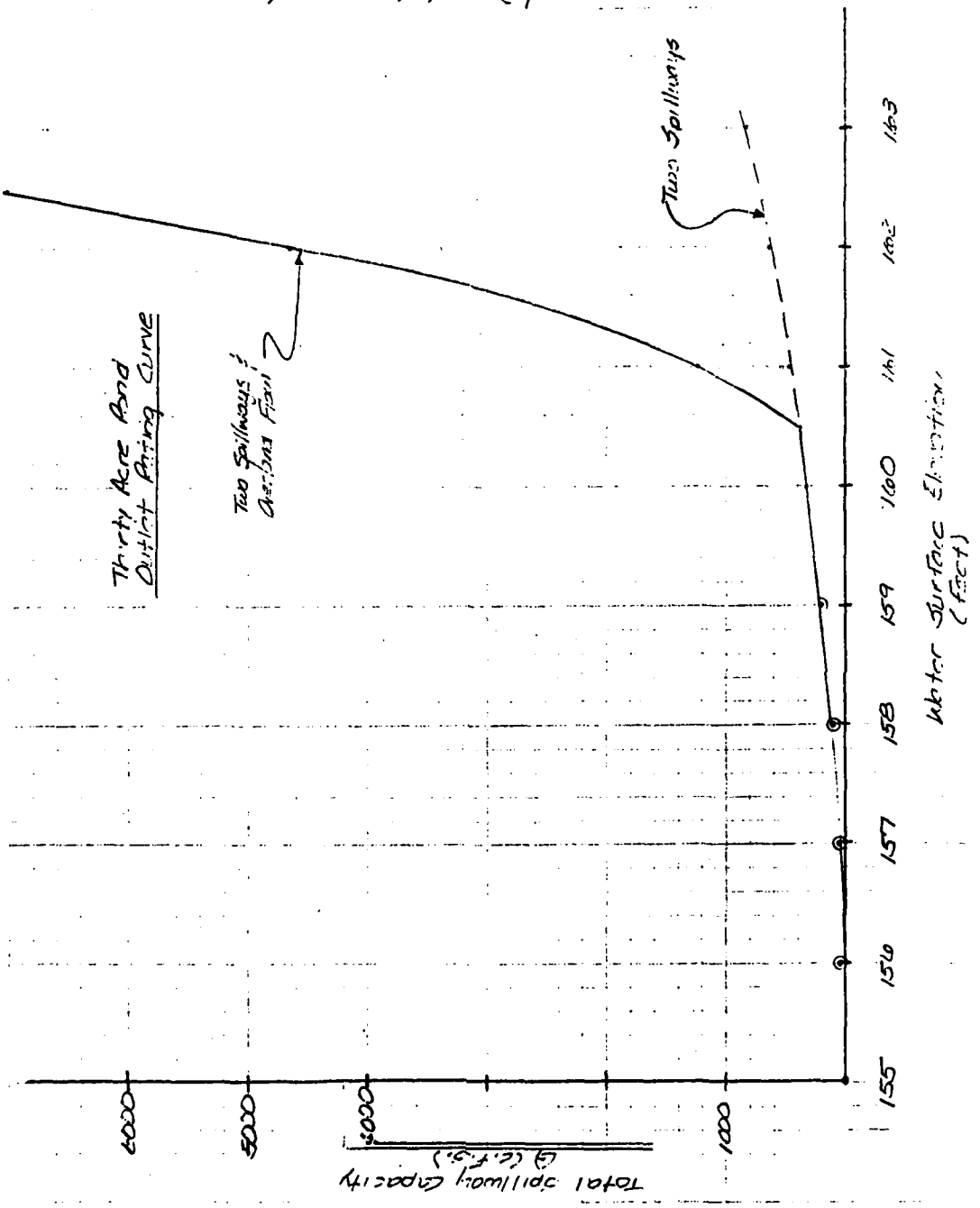
Elev. of W.S.	Q_{TOTAL}
155	0
156	23
157	63
158	109
159	204
160	326
160.5	390
161	1233
162	4654
163	9473

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT COE NYT
PROJECT Thirtyacre Pond
DETAIL Hydraulics Hydrology

JOB NO 3997-15
DATE CHECKED
CHECKED BY

PAGE 24A of 27
DATE 5/11/77
COMPUTED BY AHC

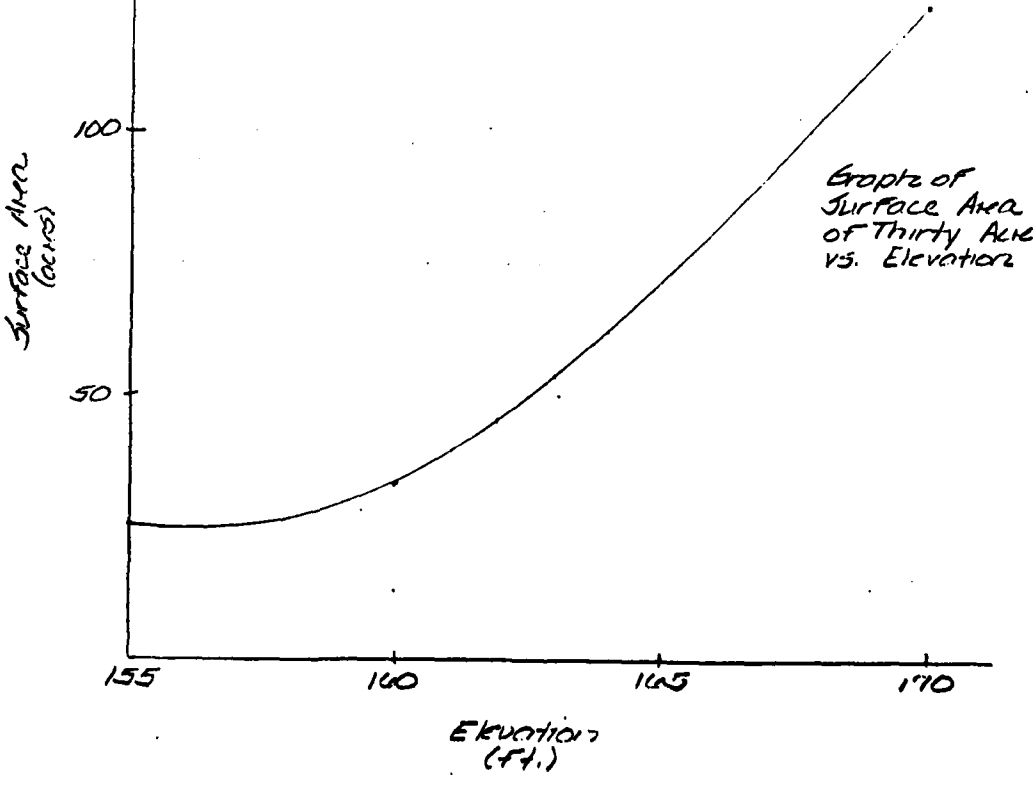


APPENDIX D-26

CAMP DRESSER & MCKEE INC. CLIENT COE Little Rock JOB NO 390-5.15 PAGE 25 of 27
PROJECT Thirtyacre Pond DATE CHECKED 6-20-79 DATE 2/28/79
DETAIL Hydraulics/Hydrology CHECKED BY [illegible] COMPUTED BY [illegible]

Elev. of W.S.	Res. Area (acres)	Calc Outflow (cfs)	Calc. S (acre-ft)	$\frac{S}{\Delta t}$	$\frac{S}{\Delta t} - \frac{Q}{2}$	$\frac{S}{\Delta t} + \frac{Q}{2}$	
155	25.7	0	0	0	0	0	
156	26	23	25.8	312	300	323	Δt = 1 hour
157	27	63	52	629	598	661	
158	28	109	80	968	914	1023	
159	30	204	109	1319	1217	1421	
160	33	326	147	1694	1531	1857	
160.5	37	390	158	1912	1717	2107	
161	40	1233	177	2142	1525	2758	
162	46	4654	220	2662	335	4989	
163	54	4473	270	3267	-1469	8004	

Δt = 1/2 hr = 1800 s



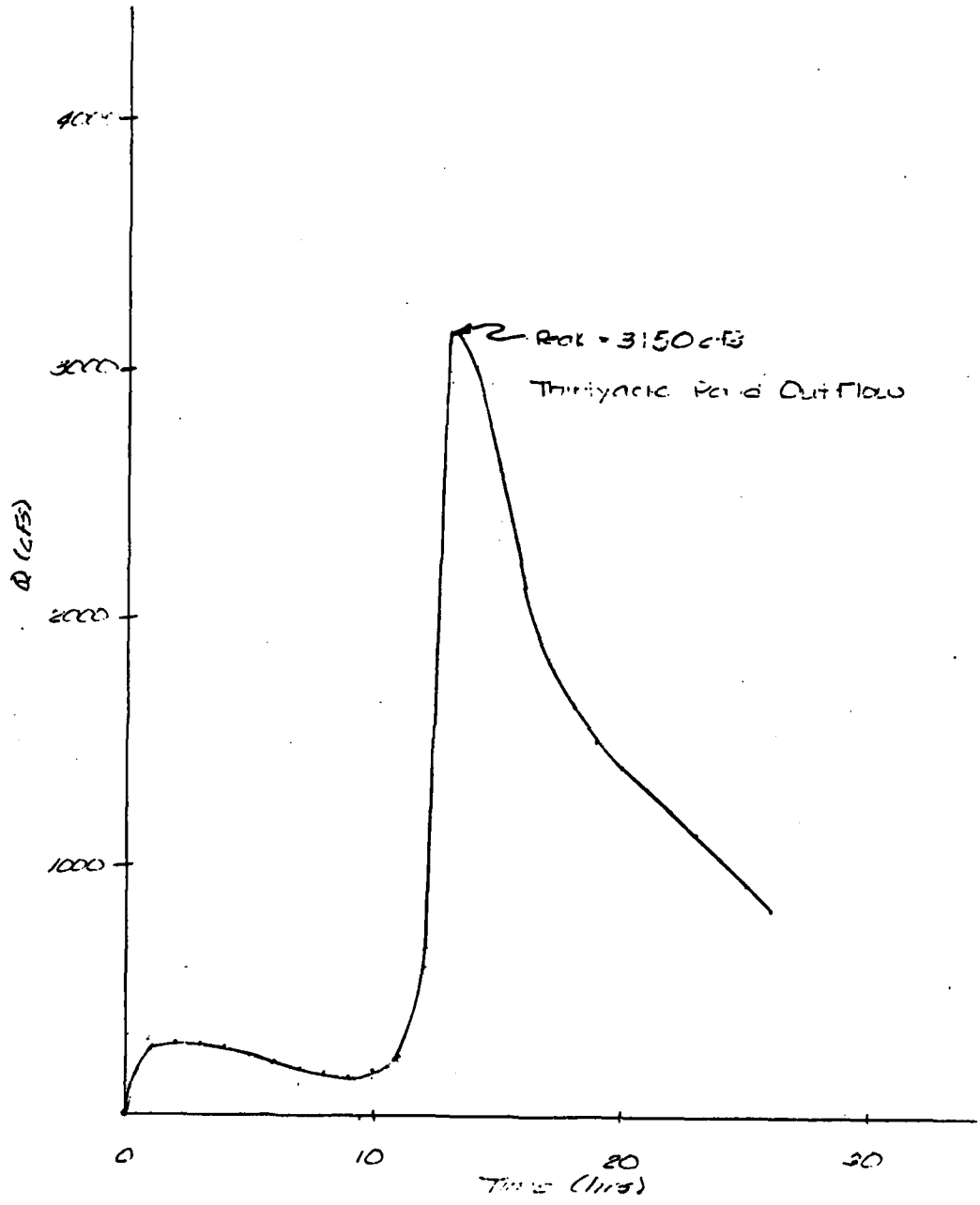
Graph of Surface Area of Thirty Acre vs. Elevation

APPENDIX D-27

CAMP DRESSER & McKEE INC. CLIENT JOE HUNT JOB NO [illegible] PAGE 26 OF 27
PROJECT Thirtyacre Pond DATE CHECKED [illegible] DATE [illegible]
DETAIL [illegible] CHECKED BY [illegible] COMPUTED BY [illegible]

Time Ld.	Obs Inflow (cfs)	Avg. Inflow (cfs)	$\frac{2}{\Delta t} - Q$ (cfs)	$\frac{2}{\Delta t} + Q$ (cfs)	Head (on 55)	Storage (Ac-ft)	Q outflow (cfs)
0	0	0					0
1	310	155			4.10	159.70	220
2	500	405	1437	1742	4.69	159.74	304
3	290	395	1446	1716	4.61	159.66	287
4	210	250	1431	1656	4.45	159.54	270
5	175	193	1386	1579	4.21	159.36	246
6	120	148	1331	1479	4.06	159.13	230
7	105	113	1259	1371	3.85	158.87	192
8	120	113	1179	1271	3.60	158.67	173
9	110	115	1118	1263	3.54	158.60	166
10	310	210	1077	1337	3.81	158.79	184
11	410	360	1153	1543	4.08	159.29	226
12	1350	1025	1305	2330	5.63	159.67	677
13	3150	2365	1651	4016	6.81	161.56	3150
14	3000	3075	854	3929	6.77	161.52	3012
15	2520	2760	900	3660	6.62	161.40	2601
16	2280	2400	1044	3334	6.43	161.26	2122
17	1800	1980	1218	3148	6.34	161.17	1815
18	1320	1110	1317	3027	6.27	161.12	1644
19	1500	1560	1382	2942	6.21	161.08	1507
20	1800	1650	1427	2877	6.17	161.05	1404
21	1310	1355	1461	2816	6.13	161.03	1334
22	1210	1260	1494	2754	6.09	161.00	1233
23	1110	1160	1526	2686	6.04	160.94	1132
24	1010	1060	1546	2606	6.00	160.86	1031
25	900	1955	1570	2525	5.94	160.82	930
26	800	850	1594	2440	5.88	160.76	826
27							

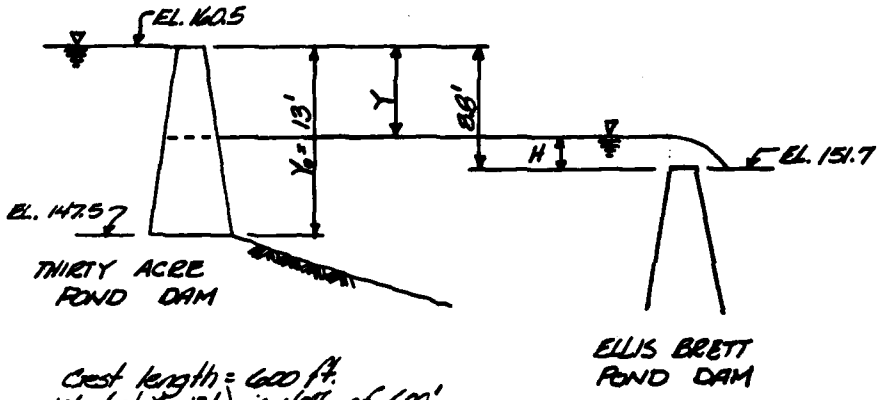
APPENDIX D-28



APPENDIX D-29

CAMP DRESSER & MCKEE INC. CLIENT CCE JOB NO 380-5-15 PAGE
PROJECT THIRTY ACRE DATE CHECKED DATE 7/17/79
DETAIL Dam Failure CHECKED BY COMPUTED BY BD

Consider tailwater effects caused by Ellis Brett Pond on peak failure flows Thirty Acre Pond Dam; ie: top of Ellis Brett Dam is above toe of Thirty Acre Dam.



Crest length = 600 ft.
W_b (at Y_b=13') is 40% of 600'
$\therefore W_b = \frac{600 \times 0.4}{13} Y = 18.5Y$

$Q_p = 8/27\, W_b \sqrt{g}\, (Y)^{3/2}$ $\qquad$ $Q_w = CLH^{3/2}$

where $W_b = 18.5Y$; $g = 32.2$ $\qquad$ where $C = 2.8$, $L = 300'$, $H = 8.8 - Y$

At Y_{max}, $Q_p \simeq Q_w$ due to tailwater

$8/27\, W_b \sqrt{g}\, (Y)^{3/2} = CLH^{3/2}$

$8/27\,(18.5Y)(32.2)^{1/2}(Y)^{3/2} = (2.8)(300)(8.8-Y)^{3/2}$

$31.1\, Y^{5/2} = 840\,(8.8-Y)^{3/2}$

$9.89\, Y^{5/3} + 89Y = 783.4$

by trial, $Y = 6.4$ ft.

Then $Q_p = 8/27\,(18.5 \cdot 6.4)(32.2)^{1/2}(6.4)^{3/2} = 3{,}200$ cfs

FIS for Brockton determined that the 100-yr flood on Salisbury Brook of 640 cfs resulted in significant flooding. Therefore, a failure of Thirty Acre Pond Dam, while somewhat diminished by tailwater, would still result in major flooding downstream.

APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTIFY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(8) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY | MO | YR
MA	325	NED	25	023	11				THIRTY ACRE POND DAM	4205.6	7102.8	22JUN79

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	THIRTY ACRE POND

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	06	BEAVER BROOK	BROCKTON	0	95600

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE - FT.)	(27) IMPOUNDING CAPACITIES NORMAL (ACRE - FT.)
NEPG	1900	R	13	13	234	125

DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
NED	N	N	N	N	15JUN79

(28) REMARKS

22-APPROX

(29) D/S HAS	(30) SPILLWAY CREST ELEVATION	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NO	(38) NAVIGATION LOCKS LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	600	C	6	242												

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
CITY OF BROCKTON		

(49) REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(50) INSPECTION BY	(51) INSPECTION DATE DAY | MO | YR	(52) AUTHORITY FOR INSPECTION
CAMP DRESSER AND MCKEE	04OCT78	PL 92-367

(53) REMARKS

31-STOPLOGS

END

FILMED

7-85

DTIC